CSIR-AMPRI

ANNUAL REPORT

2017-18

CSIR - Advanced Materials and Processes Research Institute, (AMPRI)
Bhopal - 462026, M.P. India

Annual Report

2017-18

CSIR- Advanced Materials and Processes Research Institute (AMPRI) Bhopal

Published by

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FROM DIRECTOR'S DESK

CSIR-Advanced Materials and Processes Research Institute(AMPRI), Bhopal lives upto its name and is one of the leading laboratories under the aegis of Council of Scientific and Industrial Research for Materials and Processes with an emphasis on Lightweight and Polymeric Materials, Smart & Functional Materials, Advanced Radiation Shielding Materials, Cement Free Concrete and Industrial Waste Utilization with a mandate for its application for social and Industrial benefit to people and fulfill the needs of the nation and world at large. Environmental concern of the country is of foremost importance and we contribute by state – of - art research on utilization of waste and hazardous materials in effective manner.

In recent past, the institute has transferred a number of technologies for commercialization namely, easily affordable Nanoadsorbent based filters for removal of fluoride etc, radiation shielding materials and making Pavers Block using copper tailings.

While working, developing and transferring a technology, the ultimate goal is to see it reaching the actual users. I feel proud to inform that the product launching of one of our technologies namely, hybrid composite materials has taken place this year.

The state of art equipment facility at the Institute enables the scientists and technical staff to carry out their work in effective manner. We have had a number of distinguished visitors who have helped us in our pursuit for achieving excellence in relevant fields. The dedicated team of scientific, technical and administrative staff strives in unison to achieve the set goals.

I feel privileged to share through this document, the R&D activities taken up and the highlights of our achievement during last year. We wish to keep the dedication and commitment high in the coming years also and leave no stone unturned to take CSIR-AMPRI to greater heights and be recognized as a globally acknowledged Institute in the area of social and scientific activities. The dedication and the valuable support of TEAM AMPRI has been the core of our achievements.

(Avanish Kumar Srivastava)

CSIR - AMPRI AN OVERVIEW

Advanced Materials and Processes Research Institute (AMPRI), Bhopal was instituted in May 1981 as "Regional Research Laboratory" (RRL) and officially started functioning from CSIR, New Delhi. The institute was then shifted to Bhopal and was located in Bhopal (now Barkatullah) University campus. It subsequently found a place in the present premises in December 1983. The laboratory initially had about 15 scientists, with 10 of them specialized in metallurgy/materials science. This was the core strength of the institute at that time.

The institute initially started R&D on the synthesis and characterization of aluminum-graphite metal matrix composites and natural fibres. Gradually the scope of R&D broadened to include waste to wealth (building materials and wood substitute), mineral processing, environmental impact assessment, water resource modelling and problems related to agricultural, mining, sugar mill and thermal power plant machinery components. Health assessment, improvement and failure analysis of engineering components/systems and development of lightweight materials/components/products and processes for the automobile sector constituted other activities of significance. The work was extended with FEM simulation and modelling which became an integral part of the studies in many cases. Through its activities on water resource modelling, surface treated agricultural implements, bell metal artefacts, handicrafts using sisal fibre, use of fly ash for agricultural soil reclamation, etc. CSIR-AMPRI became visible as a promising institute for rural technologies related to the specific problems of Madhya Pradesh.

The Governing Body of the Council of Scientific & Industrial Research renamed all its five Regional Research Laboratories (RRLs) to enable them to reflect a futuristic outlook. The changed profiles of the laboratories with respect to their direction of growth, orientation of expertise and accumulated excellence have all been weighed in while rechristening them. The name change from Regional Research Laboratory, Bhopal to Advanced Materials and Processes Research Institute (AMPRI) is effective from March 6, 2007. In consonance with the new identity, R&D programmes in lightweight materials such as Al and Mg alloys, metallic and polymer based composites, foams, and functional materials; nano-materials; new materials based on industrial wastes such as fly ash and red mud; and CSIR-800 projects of societal relevance have been undertaken. These programmes have an industry/user link from inception stage. A state of the art processing and characterization facility and simulation modelling capabilities are being set up to trigger new materials development, innovations and improvements.

Current Programmes and Future Perspectives

The present manpower includes 37 scientists (against the sanctioned strength of 56) that are well trained in different disciplines of materials science and other related areas along with 86 supporting staffs. The number of scientists is planned to increase to ~80 in the near future in view of the widened range of R&D activities. AMPRI is equipped with modern facilities for material synthesis, processing and property characterization such as SEM, pressure die casting machine, semisolid processing unit, rolling mill, Mg melting unit etc. FESEM, Electromagnetic forming/joining, cryomilling unit and those related to nanoscale R&D have been added in past few years.

The current activities of AMPRI are broadly categorised under:

- Lightweight Materials
- Nanostructured Materials
- Smart and Functional materials
- Waste to Wealth
- CSIR-800

In the category of lightweight materials, important activities related to Al metal matrix composites, polymer matrix composites, Al foam and Mg-based alloys. CSIR-AMPRI has laid a major emphasis on lightweight materials development like Al foam, Mg-based alloys, in-situ MMCs and nanostructured materials. Also, activities on electromagnetic forming, smart and functional materials, steel and Ti foams, and materials modelling and design are being carried out since the last 12th Five year Plan.

In the area of Waste to Wealth, the institute is mainly engaged on the utilization of fly ash and red mud. The institute has developed wood substitute technology using redmud, fly ash and natural fibers and has potential applications for making doors, panels, partitions and furniture. CSIR-AMPRI has developed radiation shielding materials from red mud and holds a US Patent on the work. The potential applications of this technology are for the shielding of gamma and neutron in nuclear power plants and for diagnostic X-ray shielding in X-ray and CT scan rooms.

CSIR-AMPRI has worked on various rural development and dissemination activities which will have large implications for CSIR-800. During 11th Five Year Plan the institute has taken up a project under Rural Sector Projects – Sisal Fiber Technologies for Rural Employment Generation. Sisal plant produces the hardest vegetable fiber which will have applications in cordage and handicrafts. The yarn and textile made out of this fiber is used for making composites for applications in sectors like housing, automobile, geotextiles, etc.

The overall objective of AMPRI is to achieve a world-class status in the area of engineering materials, component and process development. Accordingly, the HR Profile and S&T infrastructure would aim to address to the needs of both fundamental and applied research, technology development and business development in the area of materials of the future. The present resource base being created would not only provide commercial tractability for the present but also provide a root for more lucrative, elite and innovative areas of the future. It is envisaged to make the institute a place of pilgrimage for top material scientists and the stakeholders.

Vision & Mandate

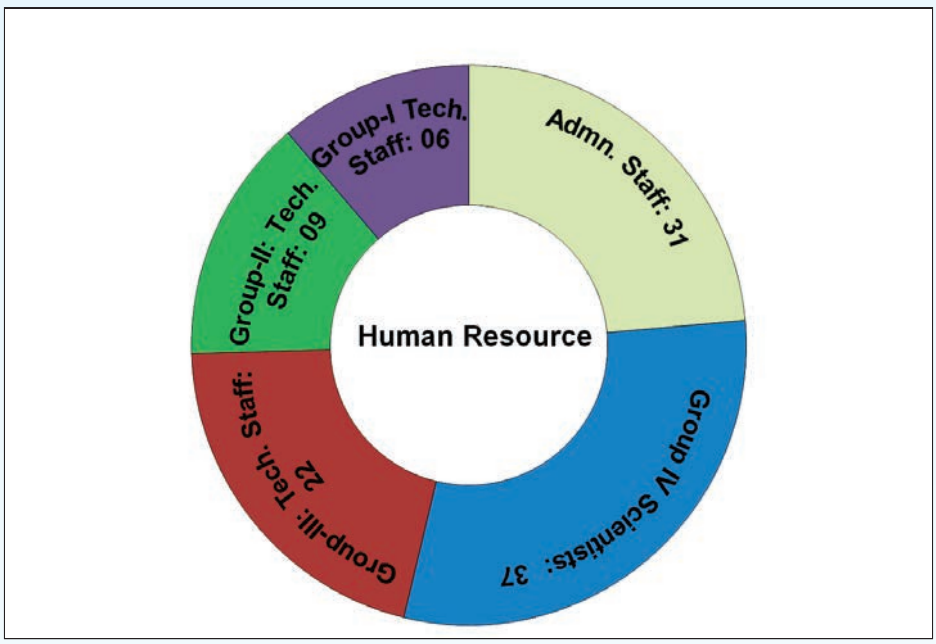
Vision

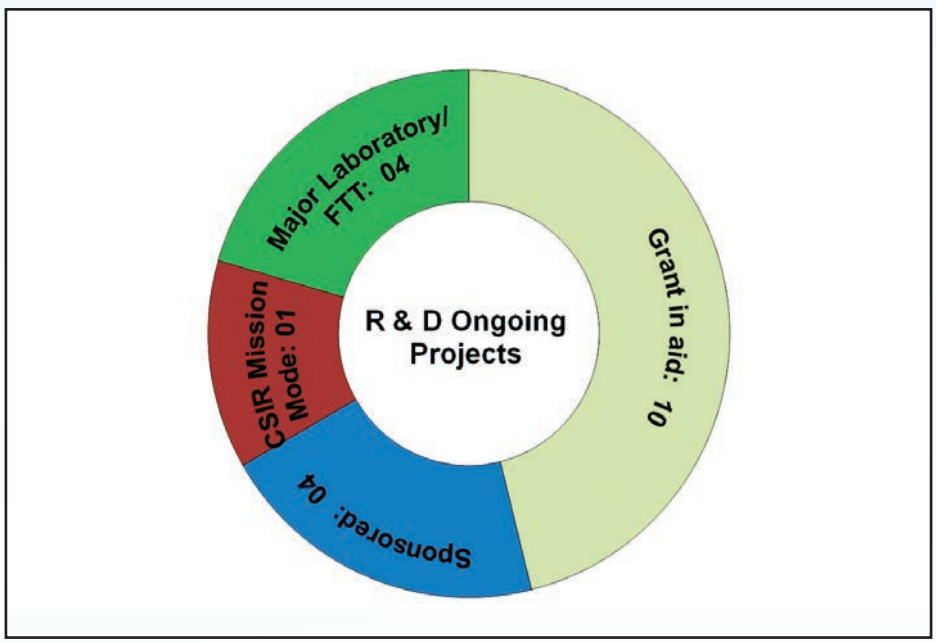
CSIR-AMPRI, Bhopal as one of the world's class leading institute amongst research institutes in the area of advanced, novel materials made through conventional and advanced processing technique with its proven expertise and facilities ultimately contributing to the CSIR mandate to fulfil the Nation's need and expectations.

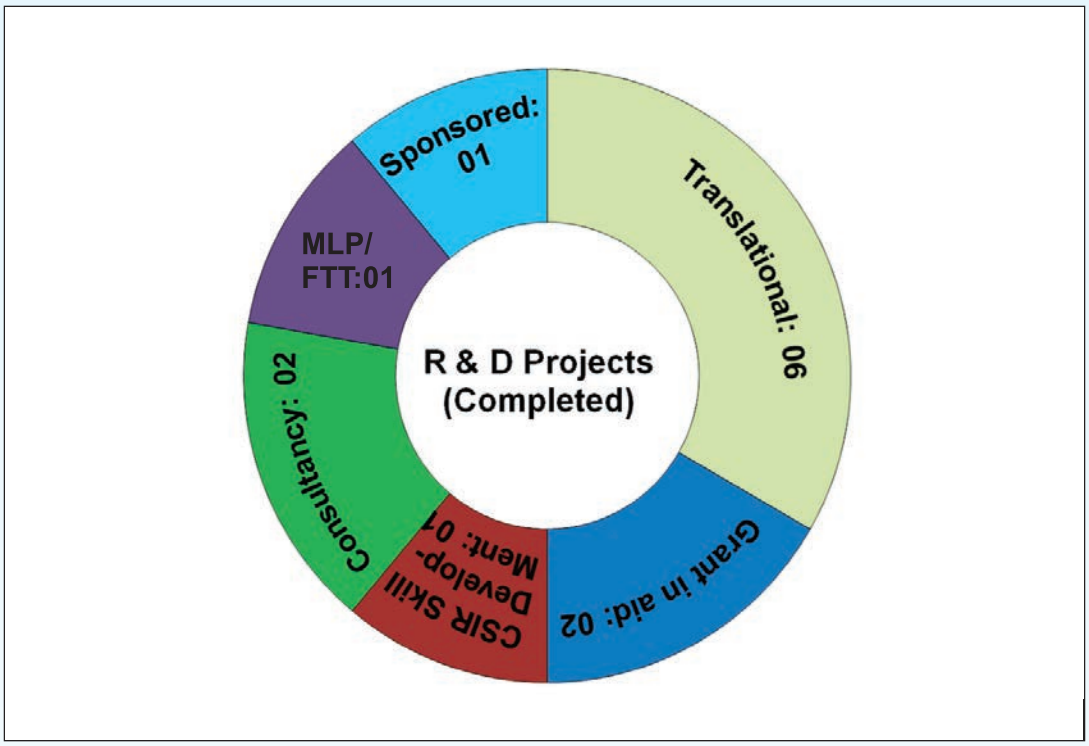
Mandate

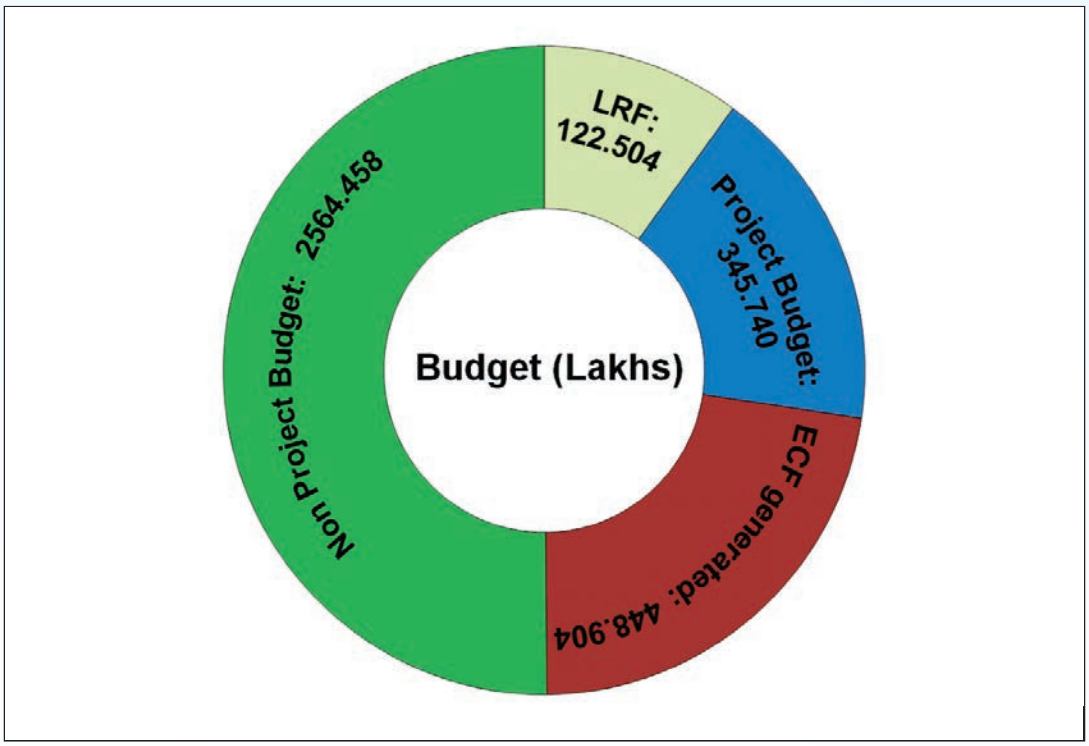
- Creating end products from more projects to substantiate industries and society's needs
- From supporting companies to create start-up industries
- From physical institutes to world class competitive collaborative institutes
- Collaboration to co-create for scientific, economic and societal advancements

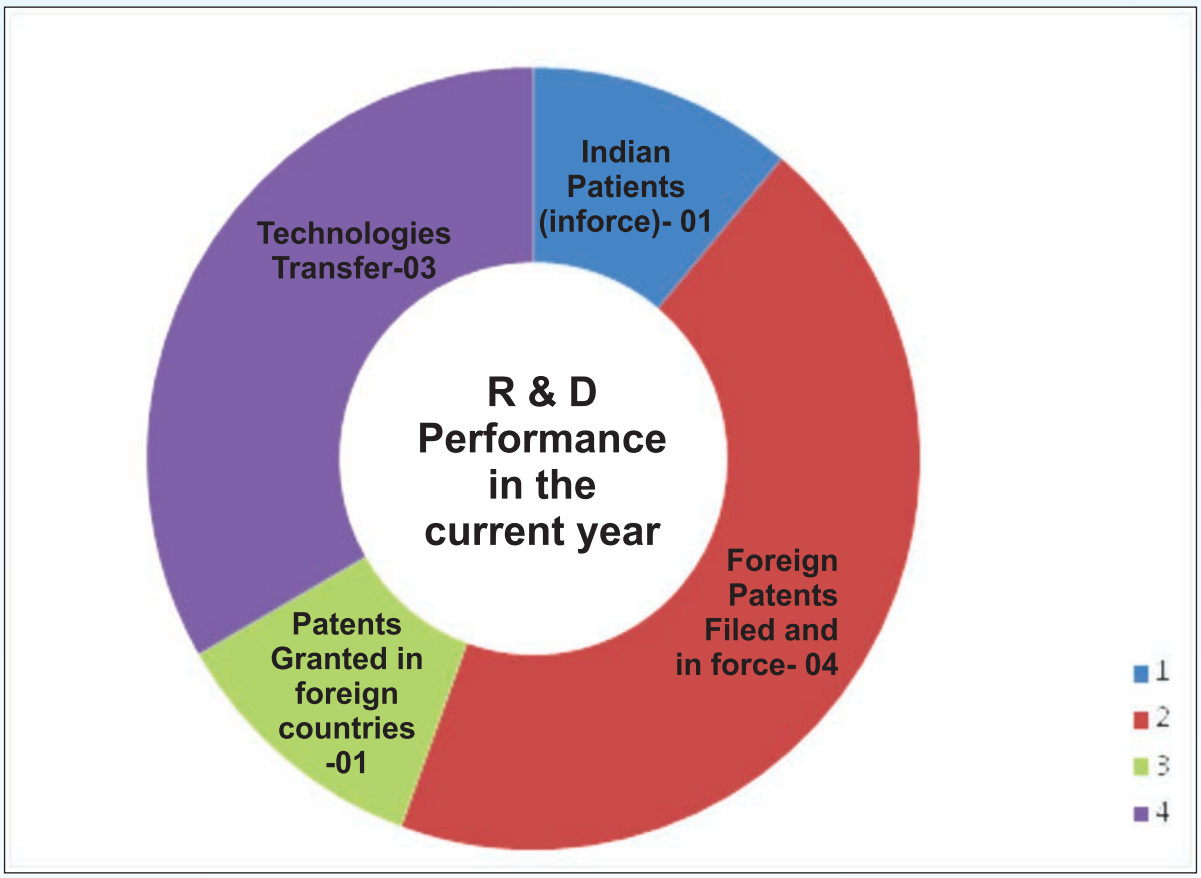
Graphical Depictions



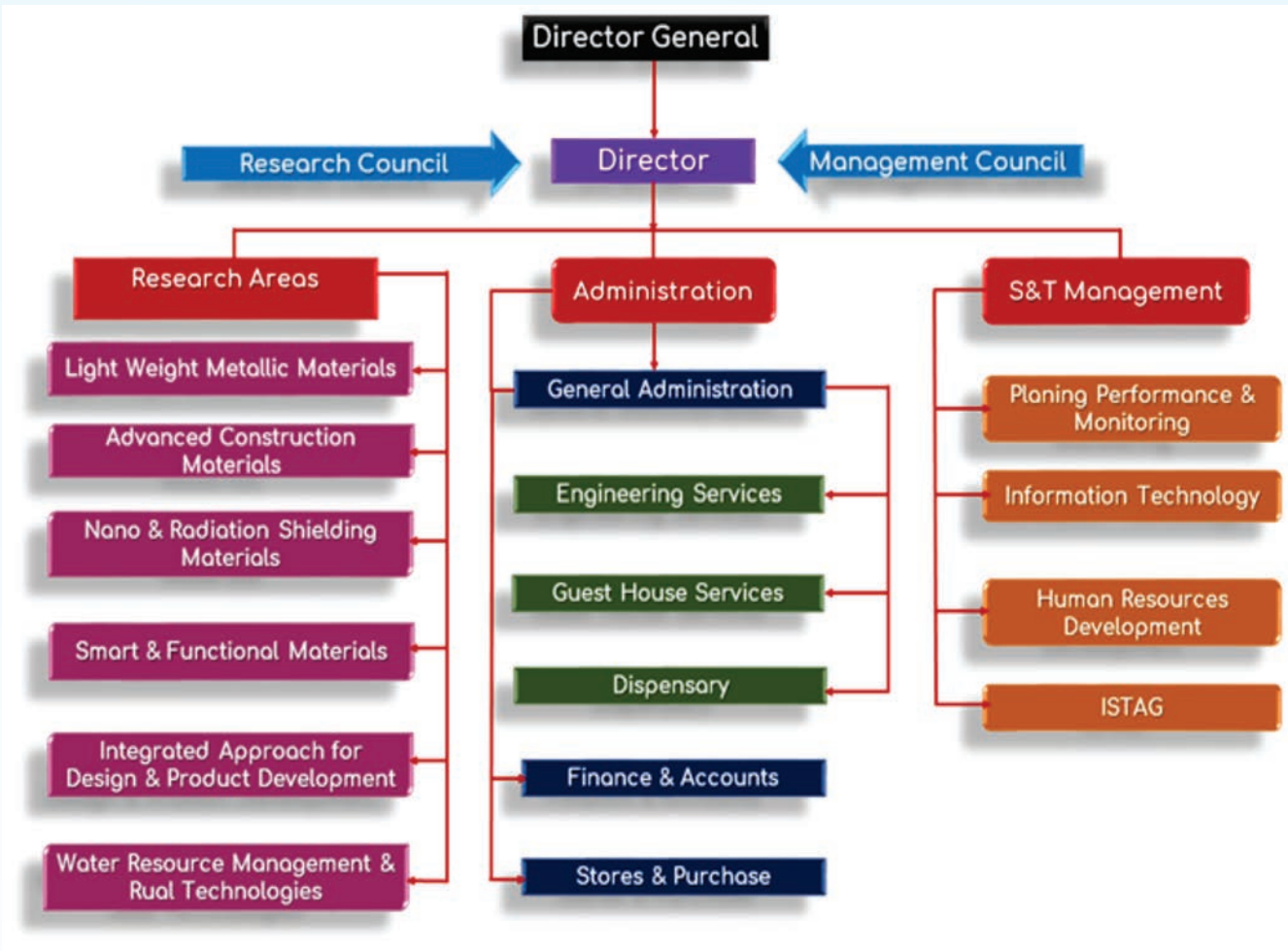



R & D Projects
(Completed)
Sponsored: 01
Translational: 06
MLP/ FTT:01
Consultancy: 02
Grant in aid: 02
CSIR Skill Develop-ment: 01


Budget (Lakhs)
LRF: 122.504
Project Budget: 345.740
ECF generated: 448.904
Non Project Budget: 2564.458


R & D Performance in the current year
Indian Patients (inforce)- 01
Foreign Patents Filed and in force- 04
Patents Granted in foreign countries -01
Technologies Transfer-03
1
2
3
4

Organization Chart



PATENTS

1 .Indian Patents (Filed & in-force):

SNo	NFNO	Country	Lab	Title	Inventors	Prov. Filing Date	Comp. Filing Date	Status
1	0181NF2016/IN	IN	AMPRI	A COMPOSITION FOR POLYMERIC FOAM STRUCTURE WITHOUT USING FOAMING AGENTS AND PROCESS THEREOF	SYED AZHAR RASHEED HASHMI, SATYABRATA DAS, PRASANTH N., AJAY NAIK	01/Sep/2016	26/Aug/2017	PP

2. Foreign Patent (Filed & in-force)

Filed in Foreign Countries

SNo	NFNO	Country	Lab	Title	Inventors	Comp. Filing Date	Status
1	0088NF2016/US	US	AMPRI	A novel multifunctional material for workability of geopolymeric system and its process thereof.	Amritphale Sudhir Sitaram, Chouhan Ramesh Kumar, Mudgal Manish, Verma Sarika, Das Satyabrata	07/Jun/2017	PP
2	0193NF2015/AE	AE	AMPRI	A NOVEL PROCESS FOR **MAKING "ADVANCED CEMENT FREE CONCRETE AND PANELS" BY UTILIZING SEA SAND AND** SEA WATER.	Amritphale Sudhir Sitaram, Verma Sarika, Khan Mohammed Akram, Padmakaran Prabha, Anshul Avneesh, Das Satyabrata	26/Sep/2017	PP

3	0193NF2015/US	US	AMPRI	A NOVEL PROCESS FOR MAKING "ADVANCED CEMENT FREE CONCRETE AND PANELS" BY UTILIZING SEA SAND AND SEA WATER.	Amritphale Sudhir Sitaram, Verma Sarika, Khan Mohammed Akram, Padmakaran Prabha, Anshul Avneesh, Das Satyabrata	27/Sep/2017	PP
4	0214NF2016/US	US	AMPRI	Advanced non-toxic Red Mud based Nano gel type functional radiation shielding materials and the process thereof	AMRITPHALE SUDHIR SITARAM, VERMA SARIKA, DAS SATYABRATA	27/Oct/2017	PP

Granted in Foreign Countries

SNo	NFNO	Country	Lab	Title	Inventors	Comp. Filing Date	Status	Grant Date	Patent No.
1	0176NF2015/US	US	AMPRI	FUNCTIONALIZED BRINE SLUDGE MATERIAL AND A PROCESS FOR THE PREPARATION THEREOF	Amritphale Sudhir Sitaram, Verma Sarika, Das Satyabrata	24/Aug/2016	IF	13/Feb/2018	9890081

ONGOING PROJECTS

Grant- in-Aid Projects

S. No	Title of the Project	Sponsoring Agency	Start Date	End Date	Cost Lakh	Project Leader
1	Water oxidation catalysis by Cheap and abundant First Row Transition Series Metal Oxides	DST	11/11/2013	10/11/2018	86.27	Dr. Archana Singh , Dr. SS Amritphale
2	Bulk Utilization of Red Mud for Making advanced Ligno -Silico - Aluminous (LSA) Geoplymeric materials	MOEF	06/01/2016	05/01/2019	63.90	Dr. Manish Mudgal
3	Manufacturing light weight high strength and glossy fi nish polymeric composites from marble and granite waste stream	DST	15/12/2016	14/12/2019	450.26	Dr. P. Asokan
4	Development and dissemination of technologies for sustainable Rural Development of primitive Banaria Tribal in Patalkot Valley, Chhindwara district, M.P. India	DST	05/07/2016	04/07/2019	20.12	Dr. Edward Peters
5	Up scaling of technology for making Advanced Non - Toxic Radiation Shielding materials of strategic importance, utilizing Industrial wastes	DST & CSIR	05/07/2016	11/07/2019	559.78	Dr. Manish Mudgal

6	Light weight foam as an electrode for Lead acid batteries	DST	27/09/2016	26/09/2021	83.00	Dr. Rajeev Kumar /Dr. D.P. Mondal
7	Development of domestic defluoridation filter using synthesized nano gamma alumina particles as adsorbent material	BT, Ministry of Science & Technology	10/02/2017	09/02/2019	29.80	Dr.I. B. Singh
8	Development of multi-elementally and nano morphologically modified advanced light weight carbon nano tubes based radiation shielding bandage useful for broad application spectrum	DST Woman Scientist Scheme	23/02/2017	22/02/2020	24.95	Dr. Sarika Verma/ Dr. S.K. Sanghi
9	Fabrication of high performance piezoelectric nano-generators	DST/Inspire Faculty Award	21/12/2017	07/10/2019	22.568	Dr. Manoj Kumar Gupta Mentor/Dr. Asoka n P.
10	Durable water repellent and stain resistant super hydrophobic textile finishes based on polymer nano-composite	DST	18.04.2018	17.04.2020	26.514	Dr. V. Sorna Gowri

Sponsored Projects

S. No	Title of the Project	Sponsoring Agency	Start Date	End Date	Cost Rs. Lakhs	Project Leader
1	Development of Al MMC Brake drums by Pressure Die Casting Feasibilities studies for	Tata Morors Bharat Oman	23/05/2016 05/01/2018	22/09/2017 Ext . 31/09/2018 04/07/2018	20.00 3.60+GST	Dr. Sanjeev Saxena Dr. Mohd

S. No	Title of the Project	Sponsoring Agency	Start Date	End Date	Cost Rs. Lakhs	Project Leader
2	Characterization and application potential of Fly ash generated at M/S Bharat Oman Refineries Limited , Bina, District Sagar, M.P.	Refineries Limited , Bina, District Sagar, M.P.				Akram Khan
3	Leachability study of Fly Ash Dumping Site and its Impact on water and Soil Quality of the Surrounding Region of M/s Bharat Oman Refineries Limited, Bina, District Sagar (M.P.)	Bharat Oman Refineries Limited , Bina, District Sagar, M.P.	29/01/2018	28/04/2019	27.24+GST	Dr. Mohd Akram Khan
4	Design and development and demonstration of diagnostic X ray radiation shielding tiles for Saideep Healthcare Private Limited, Ahmednagar, Maharastra	M/s Saideep Healthcare Private Limited, Ahmednagar, Maharastra	26/04/2018	25/07/2018	13.45 + GST	Dr. S.K. Sanghi

MLP/FTT Projects

S.No	Title of the Project	Project Code	Start Dat e	End Date	Cost Rs. Lakhs	Project Leader
1	Aluminium Composite Foams (ACFs) for Crashworthiness Application	MLP 0102	03/08/2016	02/08/2018	80.00	Dr. D. P. Mondal

2	Fibre and Particulate Reinforced Hybrid Polymeric Composite as Architectural Interior for Building Construction Sector	MLP 0103	21/09/2018	20/09/2018	242.80	Dr. P. Asokan
3	Up Scaling of technology for making advanced non- toxic radiation Shielding materials of strategic importance, utilizing Industrial wastes	MLP 0104	05/07/2016	11/07/2019	559.78	Dr. Manish Mudgal
4	Manufacturing light weight high strength and glossy finish polymeric composites from marble and granite waste stream	OLP01 15	15/12/2016	14/12/2019	135.00 CSIR+ 315.26 DST	Dr. P. Asokan

CSIR-Mission Mode Project

Title of the Project	Project Code	Start Date	End Date	Cost Rs. Lakhs	Project Leader
Mission-Intelligent System (IS) Intelligent Technologies and Solutions "Development of Artificial Intelligence (AI) controlled Linear Displacement Actuator (LDA) based on thermo-responsive smart materials (SMAs/SMPs) 'SMAILDAS'	HCP00 13	20/03/2018	31/03/2020	79.12	Mr. H. N. Bhargaw

Completed Projects

S. No	Title of the Project	Sponsoring Agency	Start Date	End Date	Cost Rs. Lakhs	Project Leader
Grant in Aid Projects						
1	Development of Porous Bio -active Ti -based Composite for Bio - implant Appli cation	DBT	02/12/2013	01/06/2017	21.772	Dr. D. P. Mondal
2	Deformation behavior of Aluminum alloy sheet in non-axisymmetric Stretch Flanimg Process by experimentation and Finite Element Method	DST	17/10/2014	16/10/2017	19.40	Dr. S. Panthi
Sponsored Project						
1	Assessment of Impact of leaching on downstream of existing ash Dyke	SGTPS Umaria M.P.	23/12/2015	22/06/2017	15.20	Dr. Mohd Akram Khan
Consultancy Projects						
1	Use of Fly Ash in agriculture at Adani Power Maharashtra Limited, Tirora, Gondia, Maharashtra	Adani Power Maharashtra Limited Tirrora, Gondia, Maharashtra	22/01/2015	21/07/2017	22.000 +Service Tax	Dr. S. Murali
2	Performance evaluation of effluent treatment plants of staple fibre division and chemical division of M/s Grasim Industries Limited, Birl agram, Nagda, M.P.	Grasim Industries Limited Nagda, M.P.	10/01/2018	09/04/2018	10.00+ GST	Dr.Mohd. Akram Khan
CSIR Skill Development Project						
1	CSIR Integrated Skill Initiative program	NWP 0100	05/12/2017	31/03/2018	51.000	Dr. J.P. Shukla

MLP/FTT Projects

1	Additive manufacturing of Advanced Micro Lattice Structures made of graphene composite materials	MLP0101	25/08/2015	31/03/2018	3:500	Dr. N. Sathish

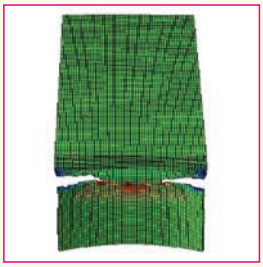
Translational Project

1	Evaluation of high Strain rate response of an automotive Crash box filled with hybrid CNT -Graphene /SIC reinforced Al-Foam	OLP 0108	01/12/2015	30/06/2017	100	Sh. Venkat AN
2	Development of Metallic Bellow through High Speed Forming/ Electro-hydraulic forming Process	OLP 0109	01/12/2015	30/06/2017	180	Dr. Meraj Ahmed
3	Highly Porous Open cell Stainless Steel and Titanium Foams for High Temperature Filters and Other Engineering Applications	OLP 0110	01/12/2015	30/06/2017	120	Dr. D. P. Mondal
4	Design and Development of automatic actuators for various automobile applications using shape memory materials	OLP 0111	01/12/2015	30/06/2017	16	Shri H. N. Bhargaw
5	Multilayered Light - weight Metal-Intermetallic hybrid laminates composites containing Al -Al_3Ti -Ti layers for armour application via Powder metallurgy route	OLP01 12	01/12/2015	30/06/2017	100	Dr. Gaurav Kumar Gupta
6	Development of Polymeric Assembled Foam	OLP01 13	01/12/2015	30/06/2017	95	Dr. S.A.R. Hashmi

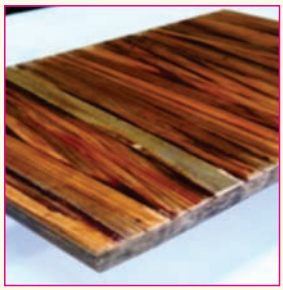
TECHNOLOGY TRANSFER

S. No.	Name of Knowhow	Name of Party	Date of Trans fer
1	Pavers Block from Copper tailings	Hindustan Copper Limited, Malanjkhand Copper project, P.O. Malanjkhand, District Balaghat (M.P.)	31/05/2017
2	A novel process for making advanced radiation shielding materials for broad application spectrum	Assurays, Noida, U.P.	24/10/2017
3	Deflouridation of drinking water using Nano adsorbant based domestic filter	MW Social Enterprise Private Limited, Indore, M.P.	01/01/2018

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद – भारत
CSIR - INDIA



R & D ACTIVITIES



Smart & Functional Materials Group

The Smart and Functional Materials Group is engaged in mainly developing such materials through both synthesising and processing. The novelty/uniqueness is that these materials are (i) that they in the infant stage of research even on a worldwide platform or (ii) advanced processing techniques are being used for forming/joining dissimilar materials after computer simulation of the process as a whole.

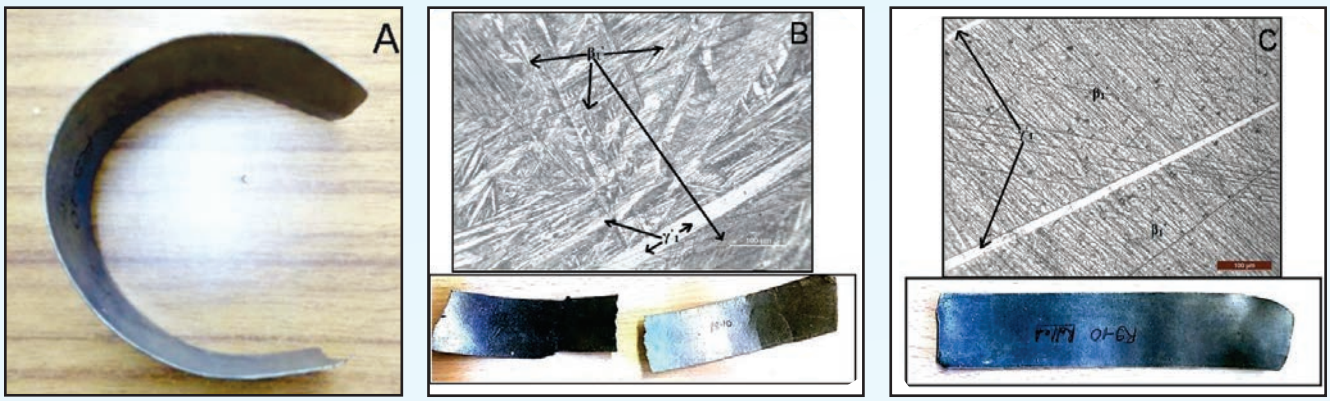
A brief of the ongoing activities during the past year is given below:

Actuator Material from Cu-based Shape Memory Alloys

In an attempt to develop low cost/better performing metallic Shape Memory Alloys components for general engineering sectors, the Cu- base system was selected. The Cu-Al base was used with different alloying alterations like Cu-Al-Ni, Cu-Al-Mn, Cu-Zn-Al system and with addition of grain refiners/pinners through liquid metallurgy route. Other binary alloys synthesized include Cu-Zn, Cu-Al, Cu-Sn. The main objective was to attain optimized alloys composition and heat treatment cycles to maximize the Shape Memory Effect [SME] and thermal stability in the wire and strip form with good mechanical properties including ductility, high temperature stability and high transformation temperatures. The activities were undertaken as a CSIR-Supra Institutional project in the 12th Five Year Plan. A complete data bank of alloys with potential of making shape memory products with properties has been drawn up. Potential alloys were hot rolled from 3mm to 0.3mm thickness; most without breakage or failure and showed excellent ductility on bending as shown in Figure A. The effect of microstructure on rolling is clearly seen in Figure. In case of some alloys though the quenched structure shows martensitic formation, yet is not conducive for rolling, such martensitic structures are shown in [Figure B].

Alloys that have exhibited high temperature (>250°C) stability and actuation will be next drawn into wires and used as actuator material for latching and unlatching can be made with this material which can be used for automobile/aero craft doors and latches. These will serve as light weight replacement to the presently used latches; this feature will be useful where weight saving is desired like in aerospace applications; such material is still not available commercially.

CSIR—AMPRI in a parallel activity under the project has developed actuators for automobiles like door, petrol tank and dickey openers have been made and tested using Nitinol wires replacing pneumatic actuators. In so doing, the intricacies of making a success story of using SMA wires as actuators for both locking and unlocking simultaneously established; presently available actuators using SMA wires can operate only for either locking or unlocking, not both together in a device. This knowhow can be soon translated using CSIR-AMPRI's made SMA wires which will finally be commercialised.



This activity identified as a lead in the 12th FYP projects will carry forward in the next step in the next step the findings for making continuous wires of different diameter and rolled strips of different thickness for use directly in components like actuators. Use of shape memory wires for actuators is a novel concept which will help in making light weight actuators for automotive and domestic use and will result in energy savings. It results due to nature of current required that is pulsating current as against constant current required for conventional dc motors used in actuators requiring less actuation times thus saving energy.

Fabrication of Densified Ni-Ti Shape Memory Alloy Strips using Hot Rolling of Elemental Powders

Fine grained Ni-Ti shape memory alloys (SMA) have been synthesized in strip form using in-situ diffusion and densification route through hot rolling. The method ensured uniform elemental distribution combined with faster diffusion and densification. The method used is cheaper and faster than hot isostatic pressing (HIP) and spark plasma sintering (SPS) used for densification of Ni-Ti SMAs through powder metallurgy route.

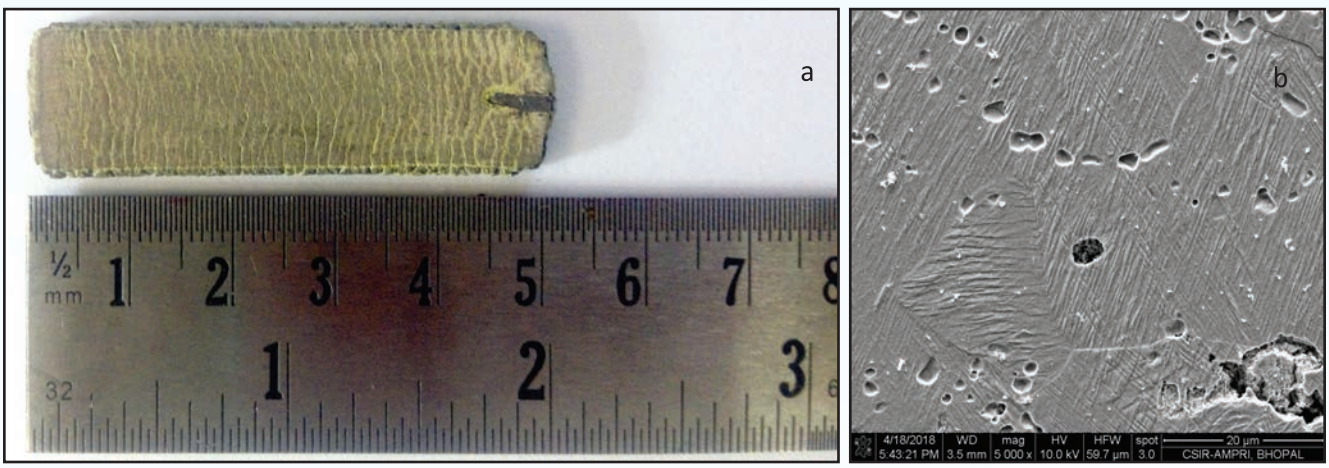
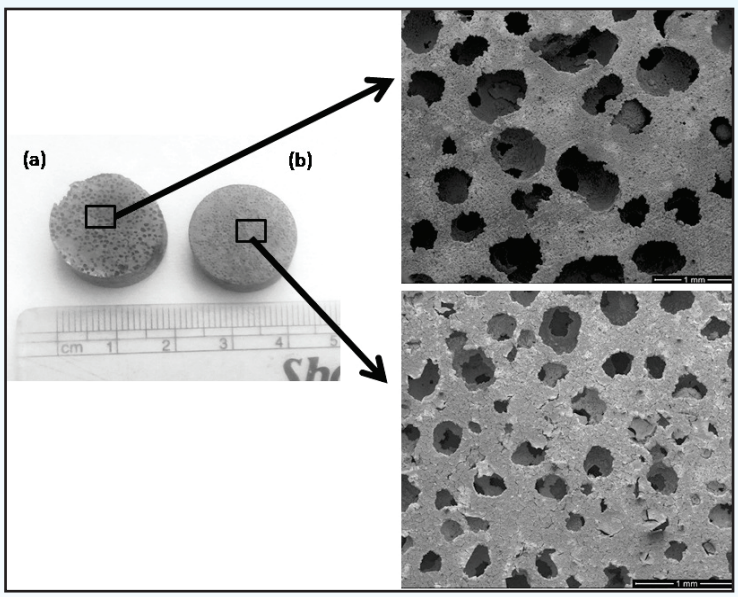


Figure (a) Hot rolled Ni-Ti strip and (b) Martensitic microstructure in Ni-Ti SMA

Titanium and Copper Foams using Lubricant Acrawax as Space Holder and Black Rock Salt as Space Holder Material

Copper and Titanium Foams have been synthesized using acrawax as the space holder material. Acrawax has generally been used as a lubricant for easier compaction of alloy powders. Metal foams have been synthesized using this space holder material in form of beads for creating pores in metal matrix. Acrawax facilitated in the formation of continuous dense cell walls which is difficult to obtain using ordinary space holder materials. Moreover, acrawax is compressible in nature and it facilitated in the formation of better and uniformly sized pores.

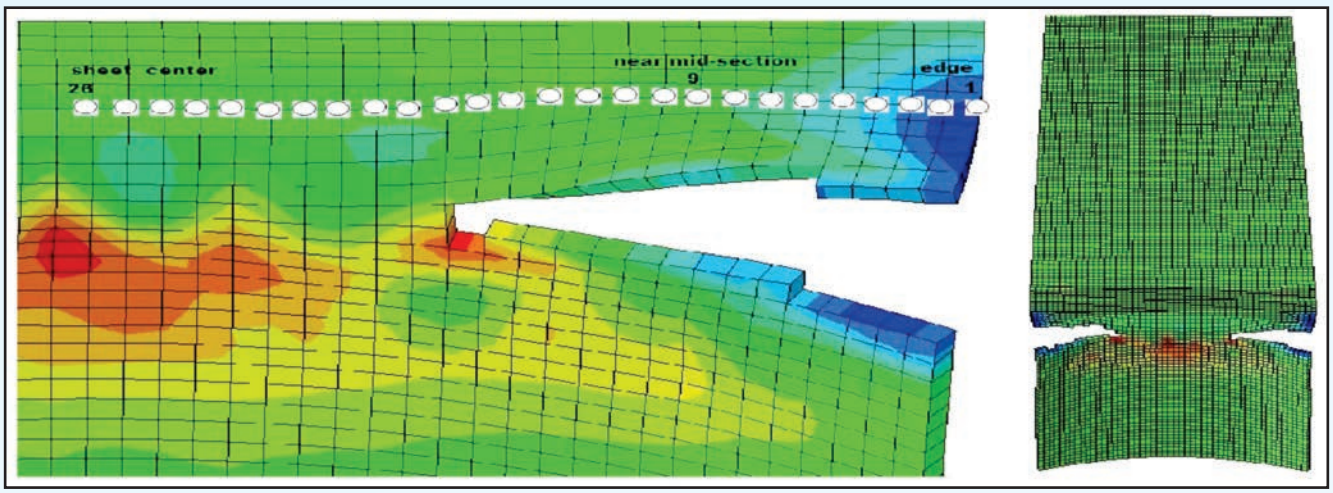
Similarly, naturally occurring black rock salt crystals have been used as space holder material which has excellent solubility in a chemical water solution. The salt got easily dissolved in the chemical solution in much lesser time compared to hot water and also yielded high strength titanium foams with excellent platea u strengths.



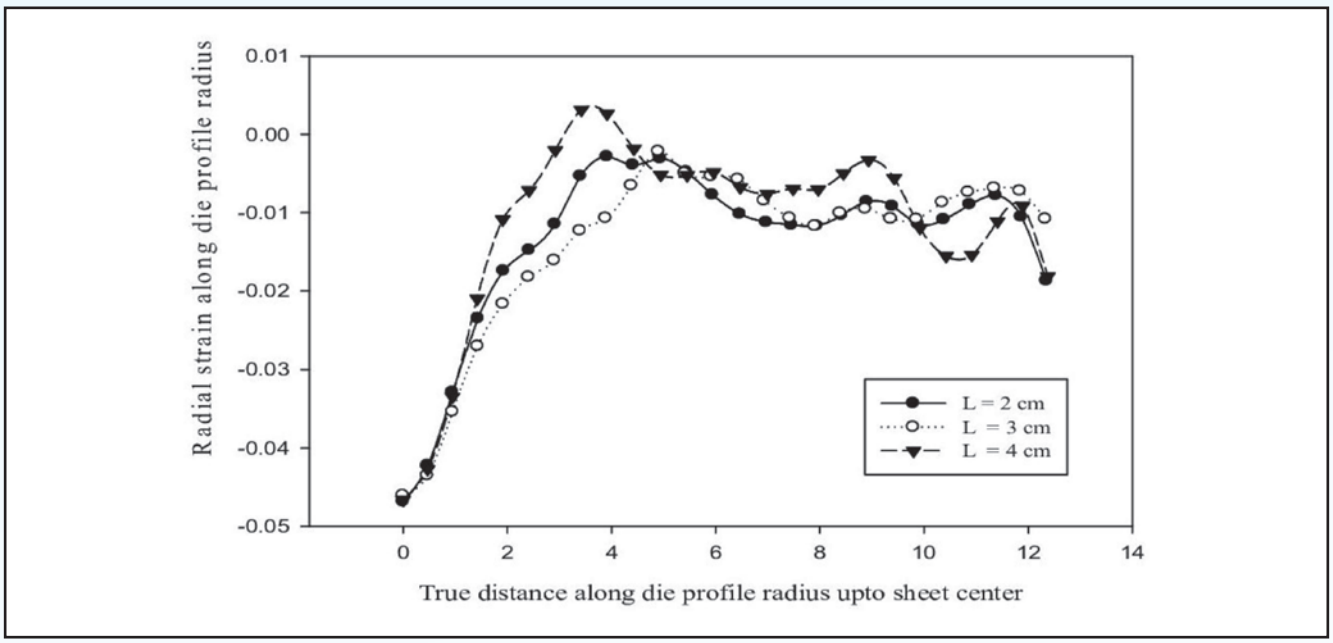
Digital and SEM photograph of titanium foams surface using (a) coarse and (b) fine acrawax beads

Def ormation Behaviour of Aluminium Alloy Sheet in Non-axisymmetric Stretch Flanging Process by Experimentation and Finite Element Method

T his activity was carried out under a project sponsored by Science and Engineering Research Board (SERB), Department of Science and Technology, Government of India. The objective of this project was to analysis the stretch flanging process with aluminium alloy (5xxx series) sheet and to find out the effect of different parameters on crack initiation location & its propagation in sheet by performing experiments using double acting press considering different geometric parameters of the process, FE analysis to optimize the parameters and validation of FE simulation results with experiments. The following figure shows the crack in the flange and graph shows the radial strain distribution in the flange along die profile radius.



Magnified Path for determination of (a) circumferential strain in flange (b) Circumferential strain distribution in the flange

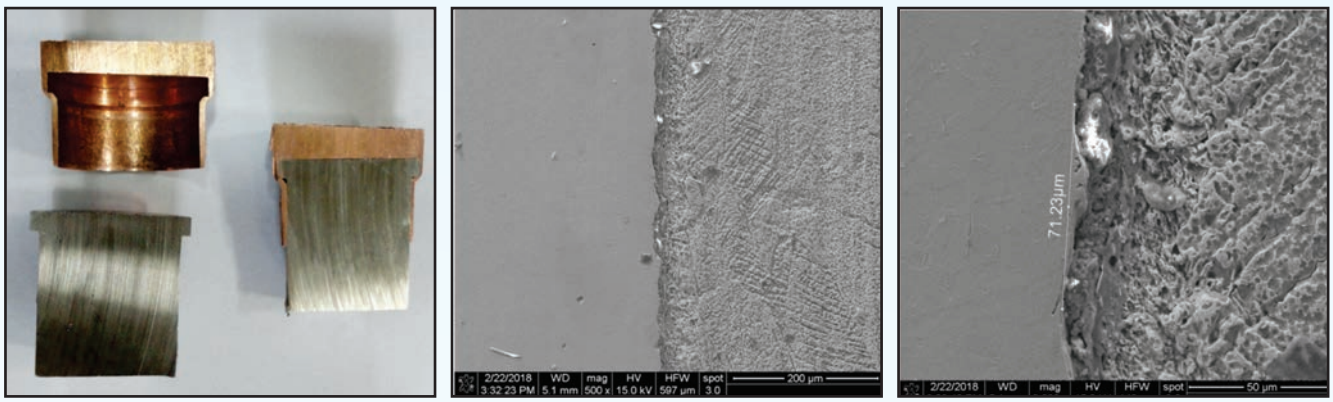


Radial strain observed in the flange after forming

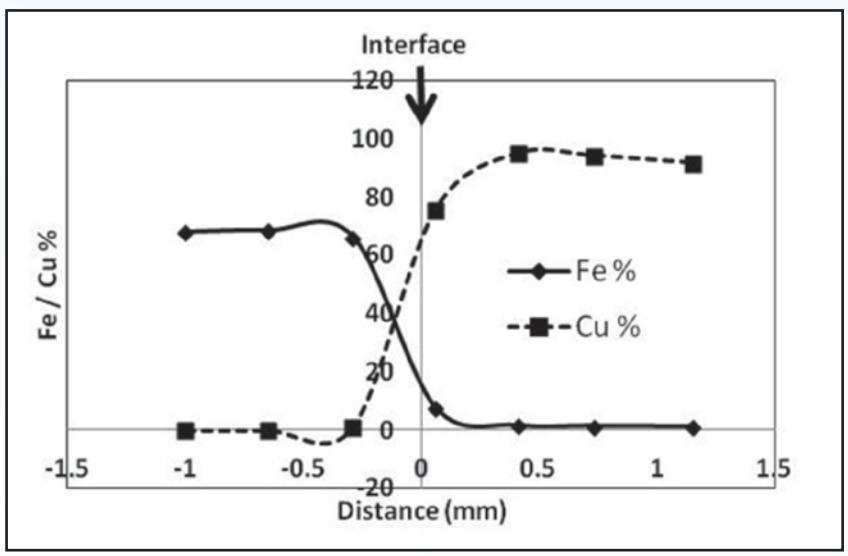
Electromagnetic Forming and Joining

High speed generated by electromagnetic field generated in an EMF machine of 40kJ capacity has been used for joining similar and dissimilar metal plates and tubes. The same machine can be used for high speed forming also. Under a project' Development of solid-state magnetic pulse welding technique for materials of

interest in accelerator program' sponsored by RRCAT Indore, the methodology of joining dis-similar metal (Cu-SS) has been established. The joint characteristics in terms of micrography, EDS and tensile strength show that good quality joint is achieved through magnetic pulse joining process. In this study, annealed Cu is joined to un-annealed SS using triple bank at discharge voltage 16 KV with peak current 152 KA. The joining has been analyzed after cutting it across length using EDM wire cut machine. It was found that a proper joint has been achieved. The FESEM image of the joint interface is shown in Fig. 1. It can be inferred that the joint quality is very sound and there is no gap at the interface. Both materials have fused at the interface into each other. The sane effect can be seen in terms of wavy profile with wavelength 70 µm of the interface. X-RAY micro analysis (EDS) across the interface shows the concentration (weight %) of Cu and Fe (Fig. 2). It is observed that both elements have diffused into each other to a certain distance (0.25 mm approx.) form the interface. However Cu content in the SS region seems to be higher as compared to Fe in Cu region. This phenomenon is self explanatory as main Lorentz force is applied to copper and it has deformed more due higher ductility and lower strength as compared to SS.



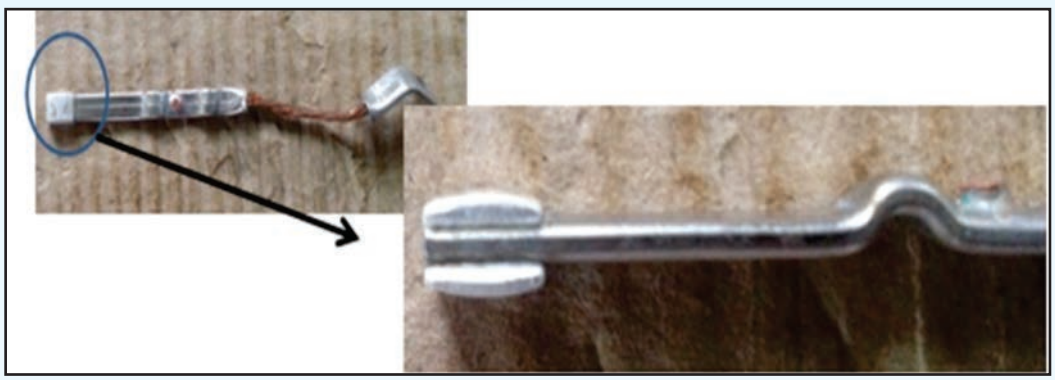
Joined component and FESEM image of Cu-SS joint interface

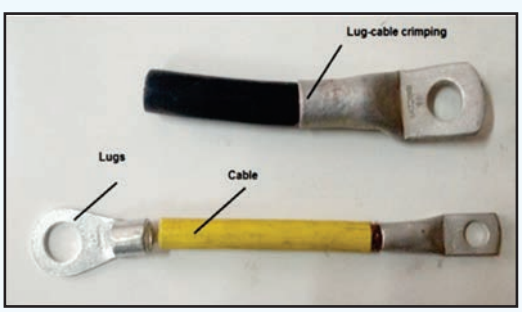


Distribution of element concentrations across interface of the Cu-SS 316L joint

Distribution of Element Concentrations Across Interface of the Cu-SS 316L Joint

With an aim of developing the joining process for industrial components through electromagnetic forming prototype illustrative components like tubular joining of dis-similar materials (nozzle of valve for Industrial gas cylinder/ lug-crimping, and flat component (electrical contact finger) have been taken up.





(a) Contact finger for contactors (b) Nozzle of commercial gas cylinder value and (c) Lug-cable crimp

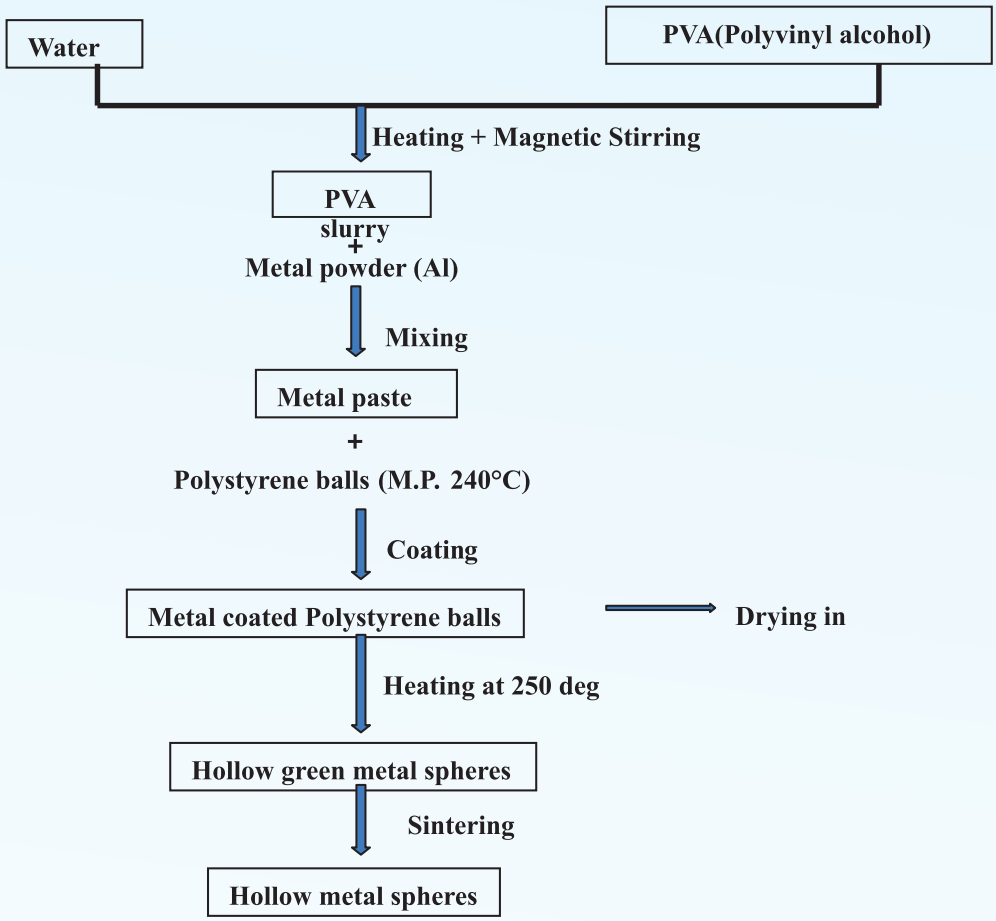
Further, studies on comparative formability sheet material in electromagnetic forming/electrohydraulic forming and conventional process has shown the efficacy and superior quality of forming using the EMF process.

Development of Hollow Structure Reinforced lightweight Aluminum Based Composite Material

In a recent attempt to make light weight aluminum foam using alternate materials, hollow reinforcements are being added to aluminum alloys as hollow structures like foams with further hollow reinforcements are expected to absorb more energy thanordinary foams. Generally closed cell aluminum foams are used for energy absorption as these will have more porosity so during compressive force both of these collapse and absorbs energy. These will find potential applications in energy absorption appliances. As a comparison, compressive strength of ordinary aluminium foams is ~ 3-5 MPa and that of the proposed composite is expected to be ~ 25-30 MPa; further energy absorption capacity of ordinary aluminium foams is ~ 3-5

MJ/m^3 and that of the proposed composite is expected to be ~ 30-50 MJ/m^3.

Processing of hollow spheres can be explained by following flow chart.



Processing steps for making hollow aluminium spheres

(a) Polystyrene balls

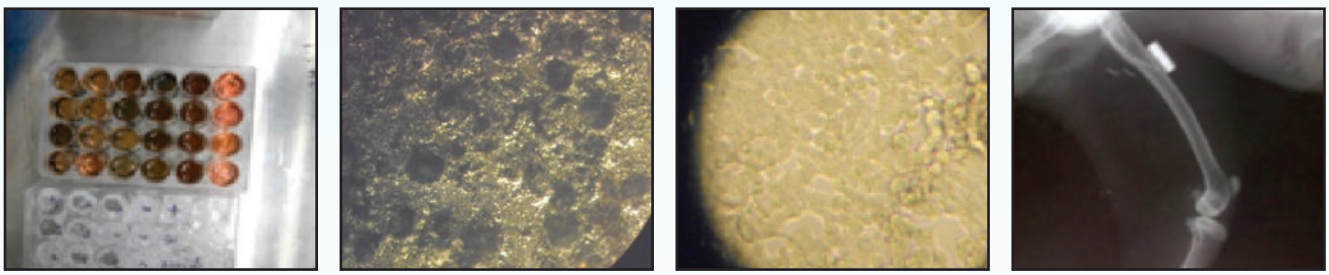
(b) Aluminum coated polystyrene balls

(c) Sintered hollow aluminium spheres

Lightweight Metallic Materials Group

Porous Bioactive Ti-Composites for Bio-Implant Applications

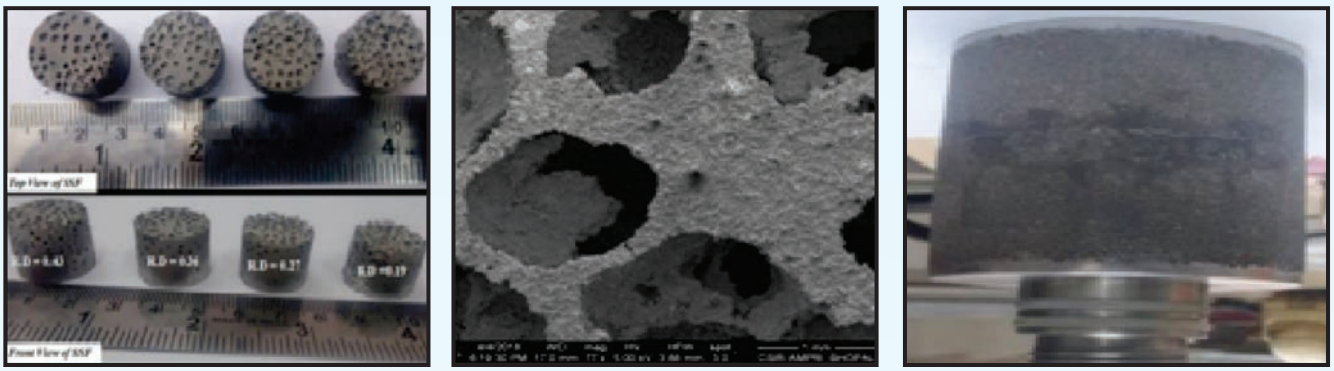
Porous Ti-foams with or without HAP coating have been made using different space holder like Urea, NaCl and Amonium bi-carbonate. The porosity varies between 40 to 80% and the pore size varies between 50 to 250 µm. The strength and modulus of these foam varies between 30 to 250 MPa and 10 to 35 GPa respectively. The corrosion resistance of these foams are very low and almost similar to that of pure titanium. During sintering some amount of TiO_2 are formed which increase its biocompatibility. Ti-Al-Co and Ti-Al-Mn foams were also made. The alloy foams exhibited better strength and modulus. The methods state that these foams can be used for bone scaffold and bio-implant applications. These foam samples are implanted into gin-pig in order to monitor their responses against these implants. No adverse effect was noted and the integrity of these foam samples with the bone is observed. After getting encouraging results and positive response from these animal trials, the HAP coated Ti-foams bone scaffold have been implanted into human body and the human trials are continuing. This activity was carried out with as a multi-institutional project with IIT, Kharagpur, Peoples College of Medical Science and Research and IISER, Bhopal.



(a) (b) (c) (d)

(a) MTT Assay of fibroblast cell iner (b) Cell growth along the cell wall of Ti-foam, (c) Adhered cell over the Ti-foam samples, (d) Ti-foam implanted in animal body after 6 months

Open Cell Stainless Steel Foam as Filter

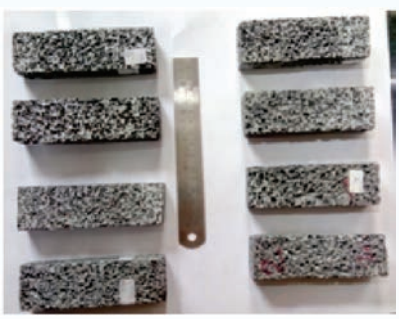


Stainless steel open cell foams made using space holders and stainless steel sintered foam filter

Open cell stainless steel foams were made using space holder technique. The size of pores is controlled by the size of urea particles. The porosity fractions of these foams are controlled by the amount of urea taken during mixing of SS powder with urea. Using the same methodology SS foams were also made using sugar as space holder. The foam samples are then used to make prototype filter for demonstration.

Al-Foams for Crash-Worthiness Applications

Closed cell aluminium foams with relative density of 0.2 to 0.3 have been made with a reproducibility of 80% and scaling of 35 kg billet in a single heat. These foams were subjected to high strain rate deformation in collaboration with IIT, Kanpur. Encouraging results have been sheared with different agencies and industries. A few foam blocks have been send to tata motors against their request for the performance evaluation at their end. The foam samples were filled into the crash box and bumper strips available in the market for small cars. The foam blocks, empty crash boxes and the foam filled crash boxes were tested using Drop test facility at ARAI pune to simulate load of 380 Kg and speed of 55Km/hr. Under such test condition addition of 400 gm of foam into the crash boxes helps to absorb energy of around 22 KJ as compared to 9 KJ by Empty crash boxes and 5 KJ by bare foam blocks (total 14 KJ). The load transfer to the plates get minimized which an engine or chassis of the vehicle can sustain. The addition of foam blocks in crash boxes will cost hardly ~Rs 2000/- (for four crash boxes) which is affordable for the car buyers for the personal as well as vehicle safety. These foams are also used to make foam core Al-sandwich panels for door and partition panel applications, wall mounting panels applications etc. Interactions are being made to make Al foam panels for blast resistance applications.



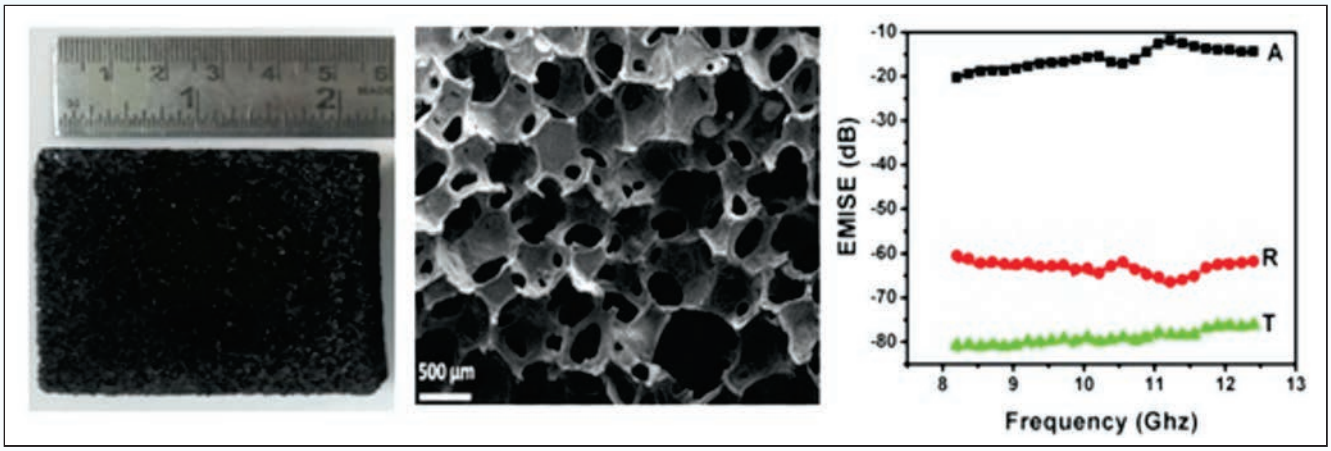
(a) Aluminium Foam strips,

(b) Full size Aluminium foam door panels (weight 15 kg)

(c) stress strain curves of Aluminium foam under high strain rate, (d) test results of Aluminium foam filled crash box.

Open Cell Carbon Foams for EMI Shielding and Battery Applications

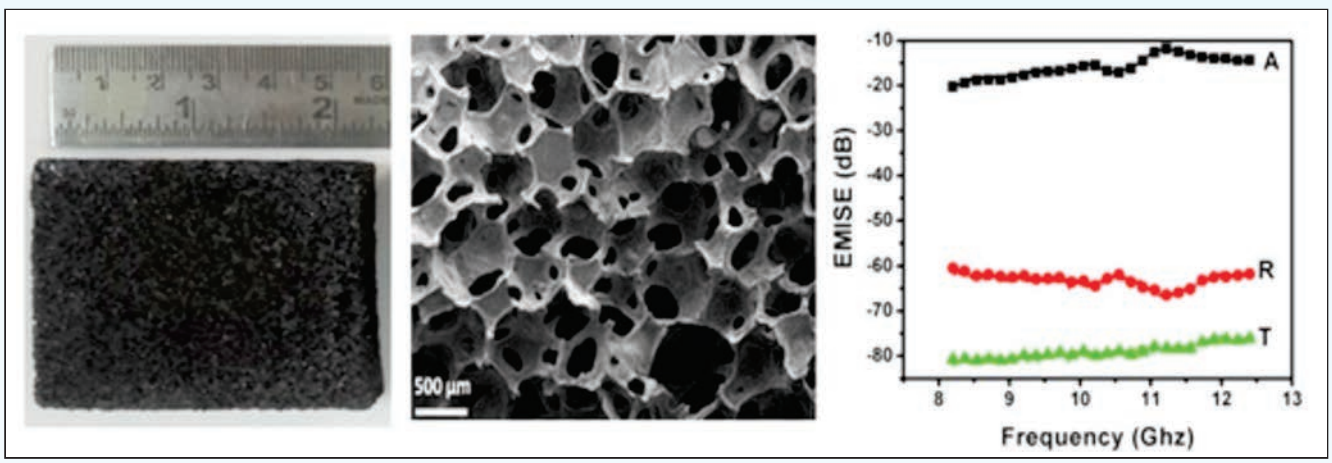
Carbon foams are non-toxic, highly porous (>90%), light materials which demonstrate a wide range of properties such as low density (>0.1-0.5 g/cc), high compressive strength (>10 MPa) electrical conductivity (>150 S/cm),high thermal conductivity (>80W/m.K), excellent EMI shielding (>-80 dB) high temperature tolerance (up to 300^{0}C in inert atmosphere), large specific surface area, low coefficient of thermal expansion, versatility, and easy processability. CSIR-AMPRI has developed carbon foam by impregnating modified coal tar pitch/resin into easily available polyurethane (PU) template foams of different densities followed by different heat treatment temperatures upto 250^{0}C in inert atmosphere of nitrogen. The major applications of carbon foam as materials for electronic package cooling, vehicle cooling systems, electrode for batteries, energy storage systems, and electromagnetic interference shielding and water purification system.



(a) Optical image (b) SEM image and (c) EMI shielding of carbon foam

Open Cell Aluminum Foam for Heat Sink and EMI shielding Applications

Aerospace and aircraft power systems functioning significantly depends upon electronic systems, which require to be shielded against electromagnetic interference (EMI). Traditional radiation shielding materials include aluminum, boron, tungsten, titanium, silver, copper, or some combination of these materials etc. But these materials have disadvantages like high density, corrosion and difficulty in processing. There is critical need to develop lightweight, effective and practical EMI shielding materials. Recently, CSIR–AMPRI has developed open cell aluminum foam for use as an EMI shielding and thermal management materials. The properties of aluminum foam are lightweight, low density (0.2-0.5 g/cc), high open porosity (>80%), large surface area, high strength (>7 MPa), high EMI shielding (>-40 dB) and good electrical and thermal conductivity. The foams with high EMI shielding specifically absorption have application in radar, antenna, covers of electronic equipment's, cones of missiles, torpedoes, missiles etc.



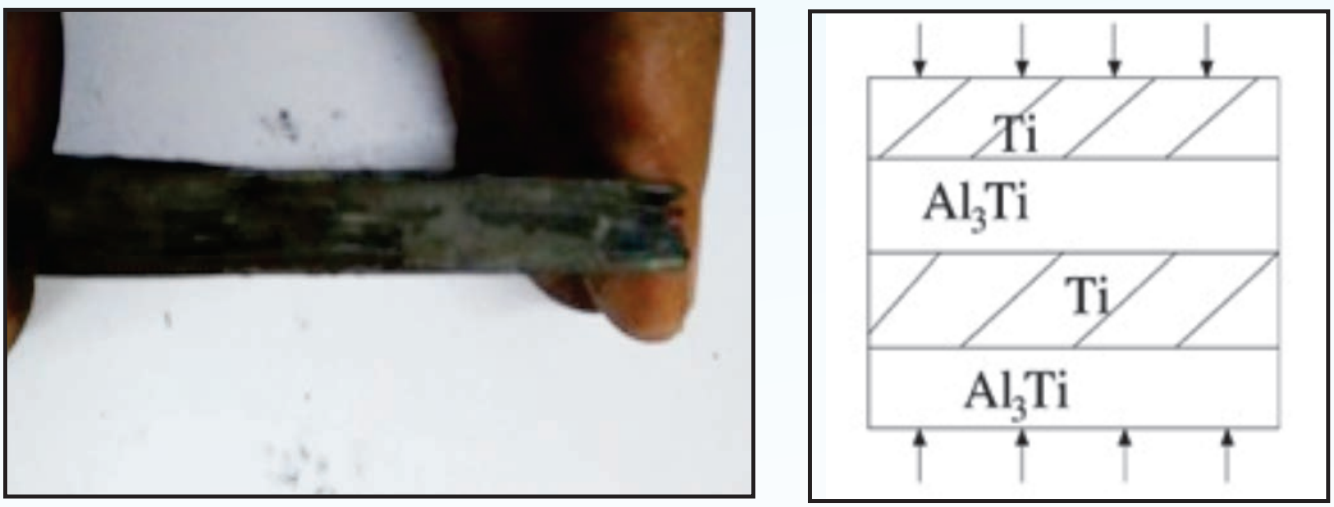
a) Optical image (b) SEM image and (c) EMI shielding of open cell aluminum foam

Multilayered Light-weight Metal-Intermetallic Hybrid Laminates Composites containing Al-Al_3Ti-Ti layers for Armour Application via Powder Metallurgy Route

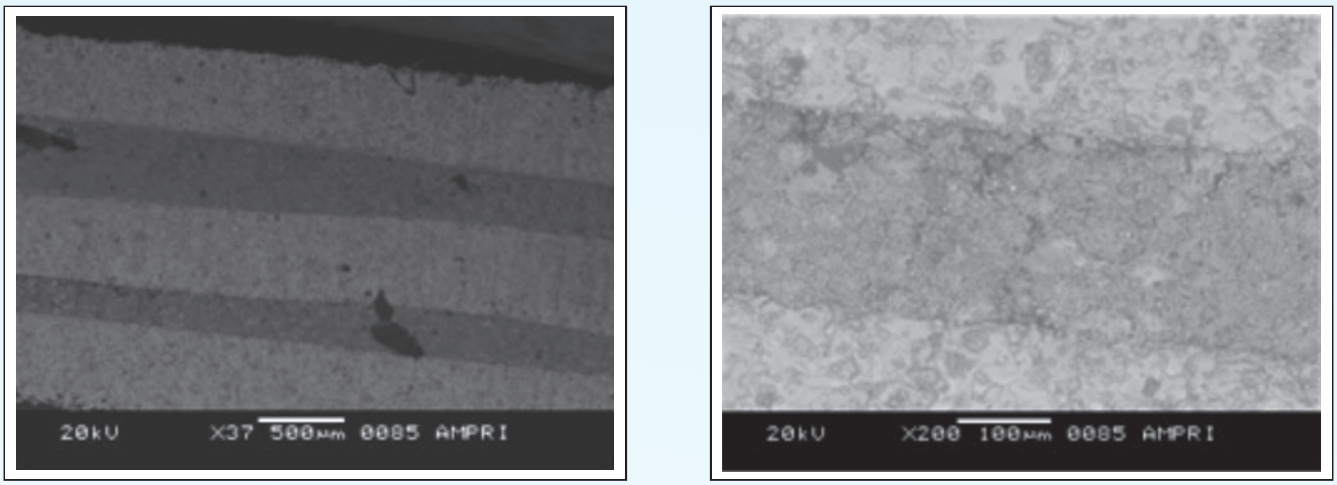
Laminated composites with ceramic front layers and metallic backing layers are being used as lightweight amours. The ceramic plate breaks up and erodes the projectile and increases the contact surface of the metallic plate by forming a hard cone and reducing the local pressure in the backup whereas the metallic backup absorbs the kinetic energy of the impactor and supports the ceramic particles. Intermetallics have higher toughness and more ductility than ceramic and thus can replace ceramic layer with intermetallics. Titanium alloys and intermetallic have been used in light weight structural and armor applications. In recent year, consolidation of Ti-Al material system has received growing attention because of formation of titanium aluminides in this system. Several technologies have been suggested for producing Titanium aluminides using Ti-Al system such as mechanical alloying, rapid solidification processing and powder metallurgy. These inter-metallic's when consolidated along with alternate Al or Ti layers using multilayered metal–intermetallic laminate approach, it offer several advantage over monolithic intermetallic such as improved strength,

toughness and superior mechanical properties. The proposed material processing route being employed is by ultrasonic joining, rolling and accumulative roll bonding of sheet/foil combined with annealing. All the methods used for synthesis of Al-Ti MIL composites use Al and Ti sheets/foils. The manufacturing of sheets/foil is an energy intensive process and very costly. In this project, Al_3Ti-Ti multilayer composites were fabricated by powder metallurgy route. The desired amount of Al and Ti powder was put in a die (50*50 mm) to form powder bed of alternate layers of Titanium and mixture (Al-75%,Ti-25%) powder. Further it was subjected to cold compaction and later subjected to hot-pressing using Spark plasma sintering in vacuum. Different temperature cycle were attempted during hot pressing and finally optimized sintering cycle was obtained. Further the hot pressed compacts were subjected to hot-rolling to enhance the density to nearly 100%. But the samples were broken during rolling due to poor density of Ti layers and brittle nature of Al_3Ti layer. Therefore Ti sheets were used instead of Ti powder and cold compaction process was eliminated as Ti compressibility is poorer than Al powder. This process gives nearly 100% densities and rolling is not required. Further pure Ti and Ti-6Al-4V sheet of 0.5mm were used. Single layer of mixture powders were taken corresponds to 0.5 mm layer thickness in hot-pressed compact. The hot pressed compact by Ti sheet approach is shown in Fig 1a and their compression test approach is shown in Fig 1b

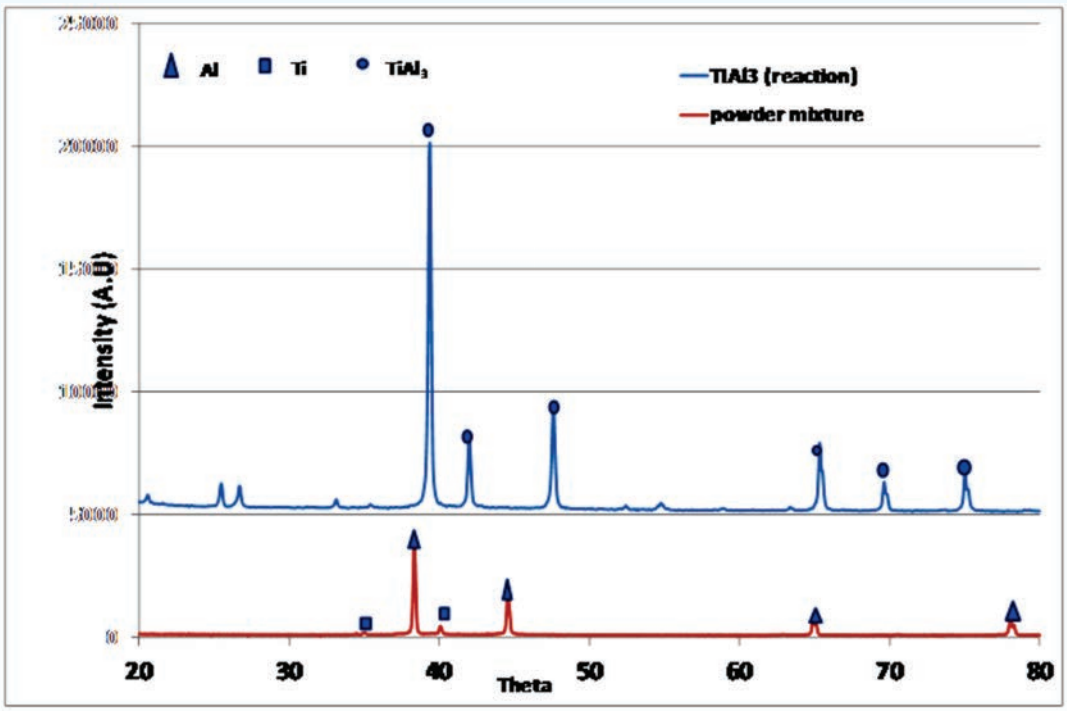
The samples of as-hot-pressed multi layer composites were prepared using standard metallographic technique. In order to further identify the different phases present in product layer ($TiAl_3$), X-ray diffraction (XRD) analysis was carried out in X-ray Diffractometer (Miniflex, Rigaku) using Cu Kα radiation (λ = 0.15406 nm).Since the $TiAl_3$ is a intermetallic (brittle), and multi-layer also contains this layer. The quasi static and high strain rate test was conducted on the same material. High strain rate test was also conducted using Hopkinson bar test. Using the results of high strain rate testing, a simulation was conducted on multi-layer composite using Bronze bullet of 10gm weight and 8 mm diameter.



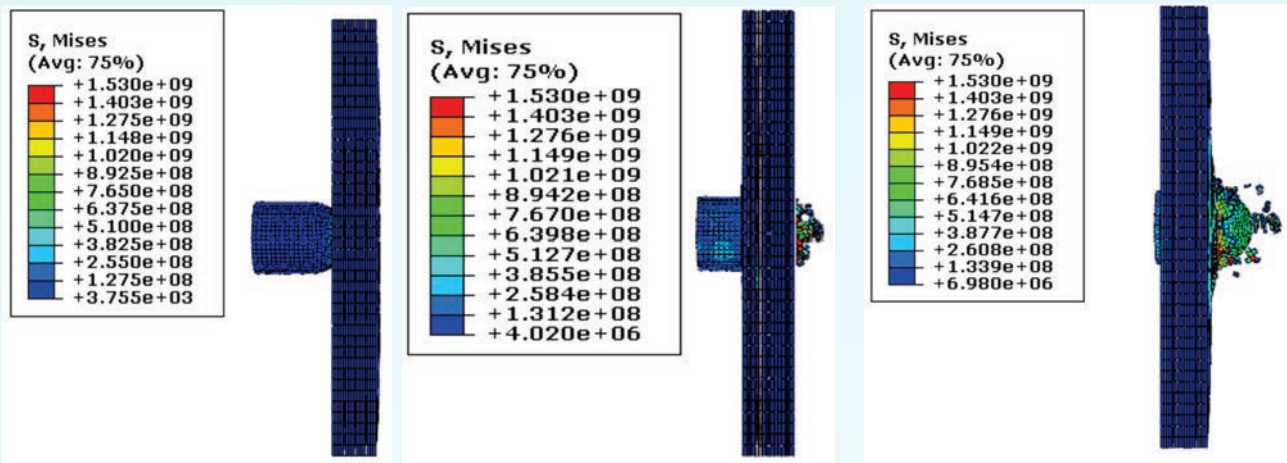
(a) Hot pressed sample synthesized by Ti sheet approach and (b) compression test

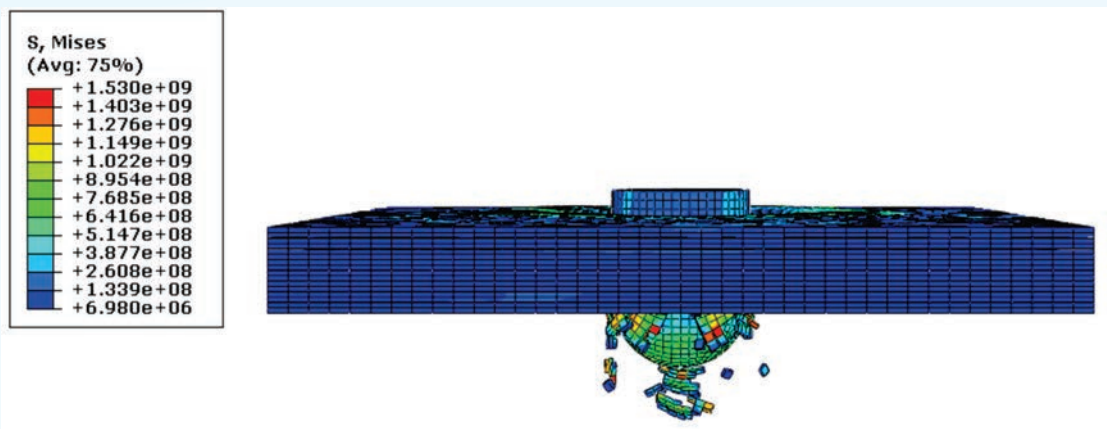


SEM micro-structures of multilayer composite (a) low magnification (b) higher magnification in back-scattered mode



XRD pattern of $TiAl_3$ layer

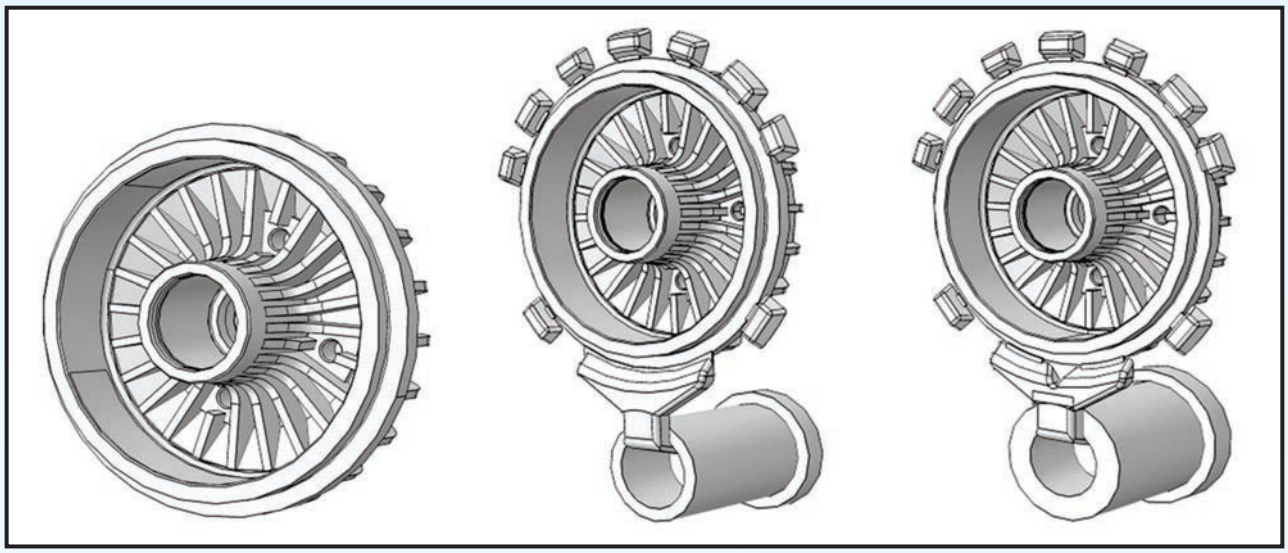




Total Thickness - 4mm, 8 - Layers Alternate (Ti-6Al-4V + $TiAL_3$)	Speed: 500 m/s

Development of Brake Drum Component using Pressure Die Casting

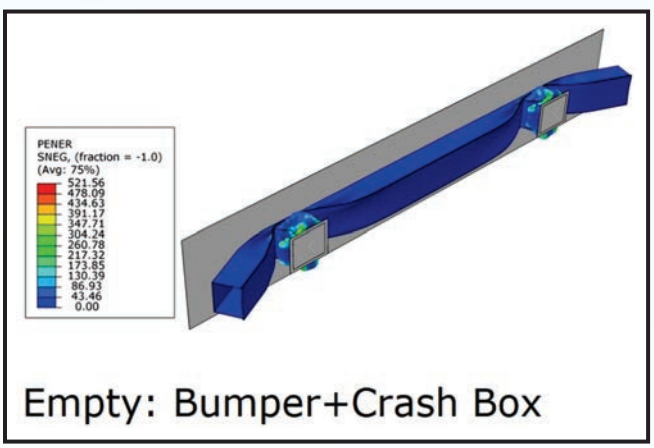
Two different alloy MMC had been characterize and based on the material property, Solid model of the brake drum component had been finalized. Based on the tensile properties achieved in the developed MMC and prevailing boundary conditions, the maximum stressed locations had been find out using Finite element analysis. After finalizing the brake drum component, for the high pressure casting of the brake drum component different options of sprue, runner and gate were tried as shown in figure. The die design will be decided based on the flow condition, casting defects after the solidification of the brake drum component. The alternative designs will be considered and based on the metal flow and casting defects after the solidification of the brake drum component the design for the die will be finalized. The maximum stress location and the location of last solidification region will also be seen while finalizing the die design of brake drum component.

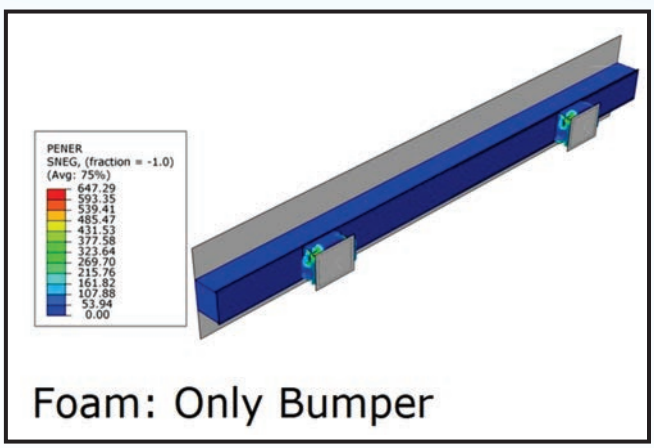


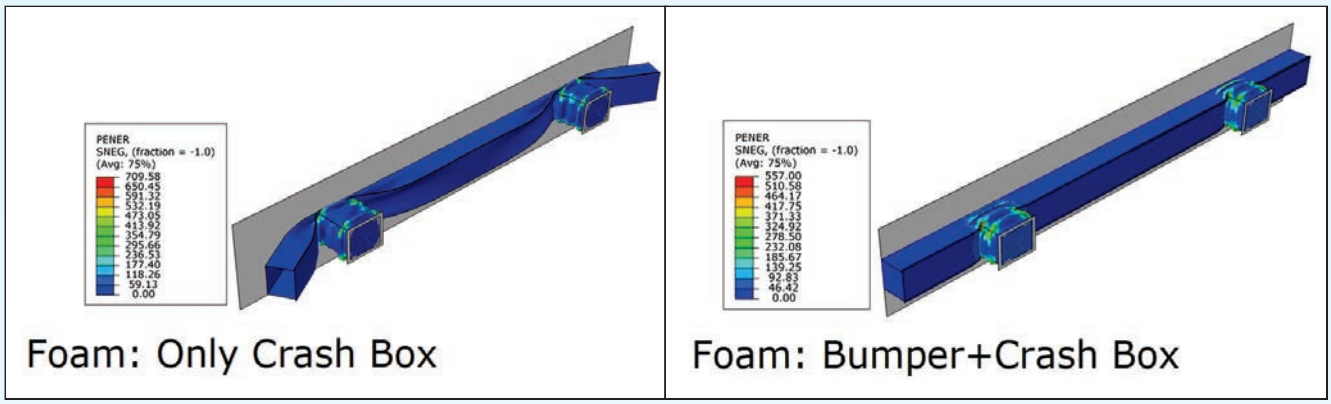
(a) Component (b) Casting Die Option One (c) Casting Option Two Brake Drum Component and Casting Die Options

Modelling and Simulation of Crash Box and Bumper Assembly

Finite element analyses had been carried out to find the utility of metallic foam as filling in Car crash box and bumper. Using preliminary dimensions of standard four wheeler car bumper and crash box, different FEM models were analysed for different loading conditions to find the optimum foam filled design to ensure the passenger safety sitting inside the car by qualifying as per standard requirement of minimum energy dissipation capacity of crash box and bumper. It is found that metallic foam increased many times the energy dissipation capacity of crash box and bumper and metallic foam has a tremendous possibility to be used as energy dissipation member in crash box and bumper in automobiles.

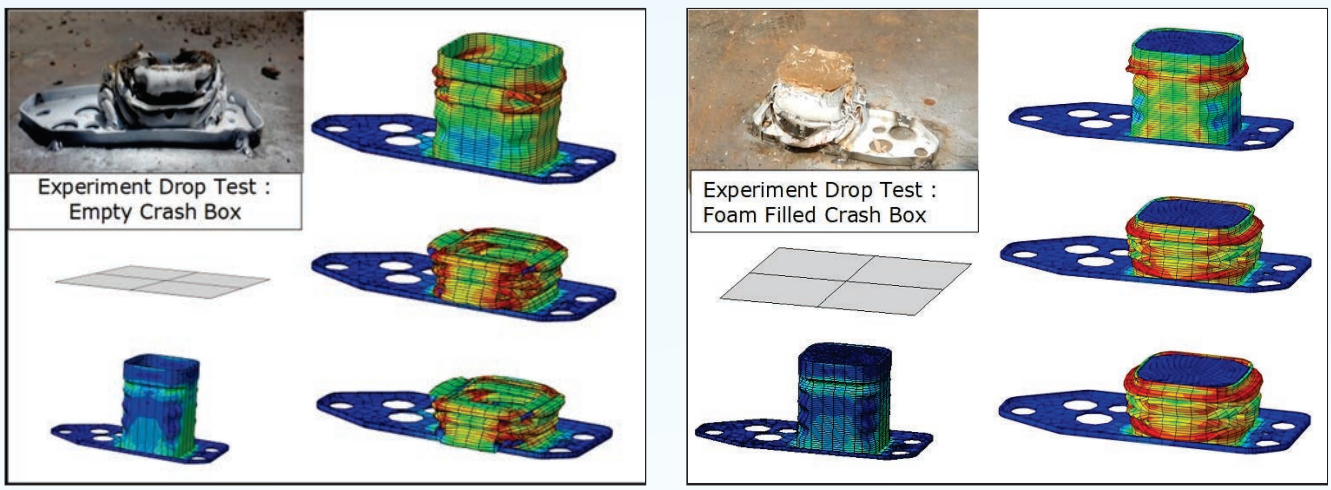






Numerical Evaluation of Empty and Foam Filled Crash Box Performance under Load Drop Test

The solid model of crash box had been generated using ABAQUS software. numerical prediction of two load drop tests of empty and foam filled crash box had been carried out. High strain rate material properties had been used in the FEM model. The FEM model predicted the experimental behaviour of load drop test well. It is found that metallic foam has a huge potential to be used in crashworthiness application.



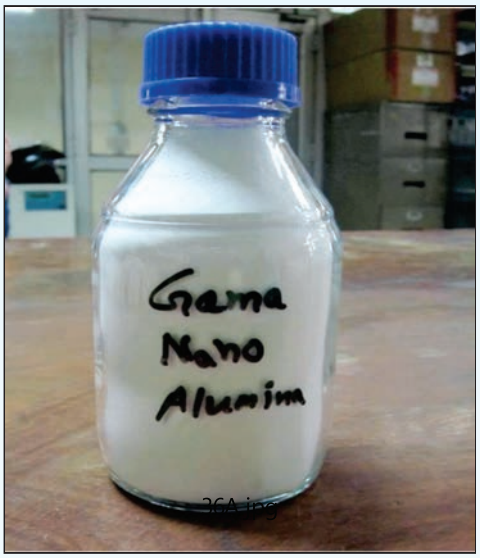
FEM prediction of Empty and Foam filled Crash Box load drop tests.

Domestic Filter for the Purification of Fluoride and Arsenic Contaminated Water

A part of the present work has been carried out under project titled "Development of domestic defluoridation filter using synthesized nano gamma alumina particles as adsorbent material." The project was started on February 10, 2017 under the sponsorship of Department of Biotechnology, Ministry of Science and Technology, New Delhi.

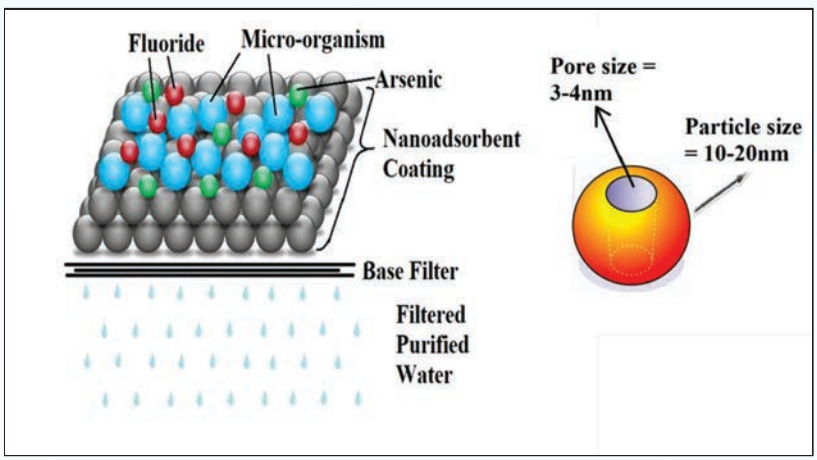
After carrying extensive research, the team has developed low cost (~600 Rs/kg) process of synthesis of nanoalumina particles as adsorbent material for removal of fluoride and arsenic from water. The developed

nanoalumina particles posses excellent surface are of ~ 200 m2/gm and showed impressive adsorption capacity of fluoride (15-20 mg/g) and arsenic (20-25 mg/g) under pH 6-8.5 of water. The developed nanoadsorbent was incorporated in the sediment filter using nanocoating method and whole filter modem was developed. The developed nanoadsorbent based domestic filter ensures that treated water consume for drinking and cooking purposes should possess concentration below the permissible limit for fluoride (< 1.5 mg/l) and arsenic (< 10 µg/l, absence of alternate source 50 µg/l) as prescribed by IS 10500.



Synthesized nanoparticles of gamma alumina as adsorbent material

The filtration technology of the developed filter is very simple, as nanoandsorbent incorporated into conventional sediment filter through nanocoating methodology, from which water filter via passing through nanopores (pore size 3-4 nm) of the nanoparticles (average particle size 20 nm).



Schematic of Aadsorption of Contaminants on the developed Nanoadsorbent and Filtration Mechanism

It is very cost effective with high removal efficiency of fluoride and arsenic contaminant of water. It has the potential to be used in the domestic as well as small community level (80-100 people). The developed filter requires no electricity in filtration and very user friendly, as simply put contaminated water via inlet of the filter and get treated water from the outlet of the filter through 3-5 lit/hour flow rate . To certain extent it removes bacteria and viruses too. The filter retains all essential mineral of water and does not result in any wastage of water. The adsorbent used in the filter has 3-4 times regeneration quality and susceptibility of leaching of aluminium in treated water is completely nil.

Developed domestic filter modem

Developed filter modem was also installed in Molukheri village of Aasta tahsil in Sehore district of M.P. state where fluoride level in ground water occurs 5-8 mg/l. After installation, developed filter was able to reduce fluoride level more than 75% in the treated water.

Demonstration of water filter installed in the Molukheri village of Aasta Tahsil in Sehore district, M.P.

The technology was transferred to the startup M/S MW social enterprises private limited, Indore on January 1, 2018. Technology is ready for transfer to other industrial partners as well.

Integraded Approach For Design & Product Development Group

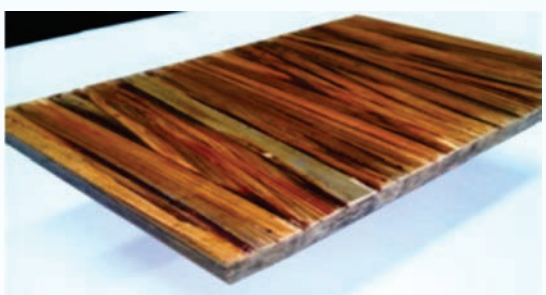
Advanced Polymer Composites provide mechanical, thermal, and structural as well as energy efficient and environment friendly solutions to industry. Development of such multifunctional materials needs integrated approach of material design, process optimization, adequate tooling, simulation and characterization.

Bamboo Wood

Bamboo is the world's fastest growing woody plant which grows three times faster than most other species. It is a renewable and versatile resource, characterized by high strength and low weight. Bamboos are known as valuable alternative resource with high physical similarities with true hardwoods. Bamboos have higher tensile strength, flexibility and can be easily employed using simple tools. It is one of the most important non-timber forest resources due to the high socio-economic benefits from bamboo based products. Housing is one of the priority items and bamboo appears to be the promising material.

In spite of having excellent properties and renewable resource, bamboo is not being used to its full potential. The major problem associated with bamboo is its short life which is an outcome of environmental degradation that becomes faster in varying environmental conditions. Moreover, natural bamboo exhibits lots of variations in size, quality and shapes that restrict its application in standard practices of construction as a construction material.

CSIR AMPRI Bhopal has developed Bamboo Wood at a laboratory scale which will be light weight, durable, weather resistant, high strength, dimensionally stable density 0.85g/cc and economical. This activity is being extended to pilot scale /commercial scale in collaboration with industry.

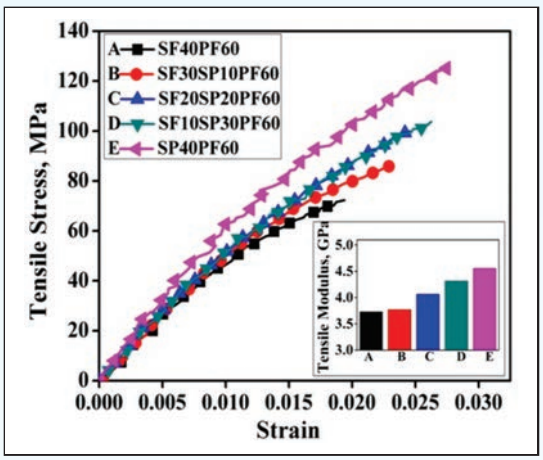


bamboo wood developed at CSIR - AMPRI Bhopal

Appropriate polymeric coatings / treatments and/or surface covers enhance the useful life of bamboo for various applications. The development of standard regular shapes such as beams, tiles, planks, lumbers, etc of Bamboo-Polymer Composites would provide opportunity to use bamboo at large scale with high potential for construction industry.

Sisal Fibril Based Composites

The natural fiber reinforced polymer composites seem to have good potential in future as a substitute for wood based materials in electrical engineering applications. Many plant fibers are being used as a resource for industrial materials. In addition to cellulose, plant fibers also contain other natural substances like lignin. The different cells of hard plant fibers are bonded together by lignin, acting as cementing material. The composites mainly consist of cellulose fibrils embedded in lignin matrix, exhibits high electrical resistance. The properties of natural fiber composites are influenced by fiber loading and their dispersion in polymer matrix. The uses of composites as dielectric as well electrical insulation are becoming more popular. Natural fiber reinforced plastics materials not only act as effective insulation, but also provide mechanical support for high field carrying conductors.



In spite of excellent properties of sisal fibre, its application is limited to low value composite products because of difficulty to maintain a uniform and homogeneous fibre distribution in polymer matrix which is an outcome of coarse diameter of sisal fibre. In order to overcome this limitation, fibrillation of sisal fibres has been carried out by mechanical disintegration process to control variations in dispersion of sisal fibres with polymer matrix. Therefore, the fibrillated sisal fibre, in the form of micro and macro fibrils are incorporated as reinforcing agent in various polymer resins to develop environment friendly material having a balanced combination of electrical, mechanical and thermal properties. The tensile strength and modulus of the randomly oriented alkali treated sisal fibril (SP), sisal fibre (SF) and their hybrid laminates are shown in Figure.

Increase in fibril content within the laminates significantly improved in tensile properties. Fibrillation of coarse sisal fibre to fine fibrils resulted in significant improvement in tensile strength. The tensile modulus showed similar trend as tensile strength, enhanced properties were observed for pure fibril laminates as compared to hybrid and pure fibre laminates. It clearly shows the enhanced load bearing capacity of fibril reinforced composites.

Radiation Shielding & Cement Free Concrete Group

The Group is working in the field of development of advanced, non-toxic materials especially in the area of radiation shielding and cement free concrete materials. The development of radiation shielding materials involves the processing of various industrial wastes namely red mud, fly ash, brine sludge etc. as the resource material for making advanced, non-toxic radiation shielding materials ranging from lower energy micro wave, radio wave to higher energy X- rays to Gamma rays and neutron shielding useful for broad application spectrum. The processing of resource material includes ceramic treatment as well as heat and chemical treatment with suitable additives. The advanced, non-toxic radiation shielding products were developed in various forms like shielding tiles, shielding panels, concrete, shielding glass, synthetic shielding aggregates, shielding concrete, flexible and mouldable products in different matrices like polymeric, geopolymeric, cementitious and phosphatic. The shielding materials developed by CSIR-AMPRI, Bhopal have been accredited by AERB, Mumbai.

Simultaneous work in the development of cement free Geopolymeric materials using fly ash as the main resource materials is being carried out . The cement free product developed include mortar cubes, concrete cubes, beams, paver blocks, reinforced green concrete structure, geopolymer based road, cementations heat insulating panels/ blocks, ferro- geopolymeric multifunctional panel, geopolymerized brine sludge composite, sea sand-sea water based geopolymeric tetrapods, geopolymeric coating for mild steel substrate, conversion of fly/pond ash into geopolymeric sand, advanced paver block using copper mine tailings.

Nano and Radiation Shielding Materials

The main thrust area includes characterization studies and application potential along with utilization of various industrial wastes such as fly ash, red mud, mine tailings, process slag, ETP sludge etc. for making value added materials. The main aim is to fabricate high dense radiation shielding red mud tiles by adding high dense and high Z materials with red mud and subsequent sintering. This will help in waste utilisation and assist the industries in solving problems arising out of waste disposal.

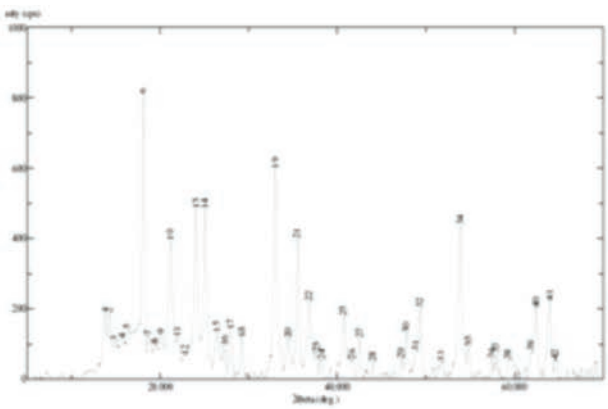
Bulk Uilitization of Red Mud for Making Advanced Ligno-Silico-Aluminious (LSA) Geopolymeric Materials

The objective of the project is to utilize huge availability of red mud and fly ash through a wider spectrum potential in the form of geopolymeric approach. This will find application in development of redmud-fly ash

based advanced lingo-silico-aluminious (LSA) geopolymeric binder. The aim of our work is to define the most favorable conditions enabling the utilization of the geopolymerization process in the development of multifunctional materials based on red mud using fly ash. On the basis of results the optimal conditions for geopolymerisation and the effect of the main synthesis parameters would be determined with respect to satisfactory mechanical and other properties of the developed LSA geopolymeric materials. The developed inorganic polymeric materials produced by the geopolymerization of red mud and fly ash would develop satisfactory compressive strength leading to use of these materials for construction industry. This will ensure the bulk utilization of two industrial wastes namely red mud and fly ash.

Identification and Characterization of Red Mud: The Red Mud used for this experimental work was obtained from HINDALCO Renukoot (U.P.). Around 15 tons of Red Mud has been transported to CSIR-AMPRI Bhopal.

Red Mud

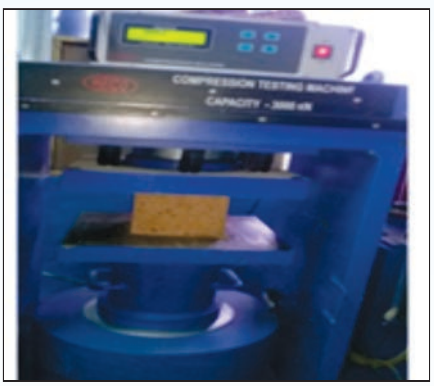


XRD of Red Mud

The LSA Geopolymer Binder was developed using Red Mud- Fly Ash and Ligno Silico (LS) Alkaline Activator. The developed LSA Geopolymer binder was evaluated for compressive strength properties. First control mix was developed using Fly Ash only and afterwards Fly Ash-Red Mud mix proportion optimization under progress to develop Red Mud-Fly Ash based Geopolymeric Binder.

Preparation of Fly Ash Red Mud based Geopolymer Binder

Moulds Filling



Evaluating CompressiveStrength of Fly-Ash Red Mud based Geopolymer binder

Performance Evaluation of Effluent Treatment Plants of Staple Fibre Division and Chemical Division of M/s Grasim Industries Ltd, Birlagram, (M.P.)

The above project has been awarded to CSIR-AMPRI, Bhopal by M/s Grasim Industries Limited, Birlagram, Nagda (M.P.) to evaluate the performance of Effluent Treatment Plants of Staple Fibre Division and Chemical Division of M/s Grasim Industries Limited, Birlagram, Nagda (M.P.). In connection with the project work, a team of scientists from CSIR-AMPRI, Bhopal visited Grasim, Nagda on November 16, 2017 and held discussion with senior officials regarding the scope of work pertaining to the activity. Accordingly, a detailed project proposal was prepared and submitted to Grasim Industries Limited, Nagda. Work Order was received and thereafter a team of Scientists and Research Scholars visited M/s Grasim Industries Limited, Nagda and collected 09 samples of industrial effluents from ETP of Chemical Division (CD) and 18 samples of industrial effluents from ETP of Staple Fibre Division (SFD) together with 02 sludge samples (one from each Division - CD & SFD) in the presence of senior officials of both the Divisions. pH determination and DO fixation was carried out at site and all the samples were brought back to CSIR-AMPRI, Bhopal for detailed analysis for physico-chemical characterization like pH, alkalinity, hardness, total solids, chlorides, sulphates, DO, BOD, COD etc. Heavy metal analysis of samples mainly for raw influent and final treated effluent was carried out in detail.It can be concluded from the detailed sampling and analysis carried out by CSIR-AMPRI, Bhopal for various parameters that both the ETPs are adequate for treatment of effluents generated from staple Fibre Division and Chemical Division respectively to meet the prescribed norms. All the unit operations of ETP are performing as per their designed capacity. The analysis results of samples from Sewage Treatment Plant at inlet and outlet also confirm that the treated sewage quality is well within the prescribed norms.

Research team at site

Research team at site

Feasibility Study and Process Development on the Conversion of Fly/Pond Ash into Fine Aggregate

One of the emerging area for the utilisation of fly ash is in the production of aggregates as substitute for conventional aggregates. Fine aggregates are main components for making concrete and its usage in concrete around the world is second only to water**.** The project relates with the study to convert Fly ash/Pond ash into fine aggregates using geopolymeric route. Geopolymers are a new generation material with diverse application in building industry and waste management. It is produced by reaction of alumino-silicate raw material in alkaline environment under hydrothermal conditions.

For the present study, ash samples were collected from silo and ash dyke I from NTPC Mouda power Station near Nagpur. The Physico-Chemical characterisations including mineralogical and morphological studies of the samples were carried out using standard methods. Conversion of Silo ash into fine aggregates was carried by varying NaOH concentration at different temperature range. Similar experiments were carried out with Pond ash samples.

The tailored geopolymeric sand was evaluated as per Standards of fine aggregates following IS codes. After optimizing aggregate properties, the synthetic aggregates were tested for civil engineering applications to find its suitability for replacement of river sand.

The production of aggregates using Fly ash /Pond ash has potential for large scale utilization as replacement of river sand. The study would revolutionize the construction sector as well find solution to fly ash related environmental problem.

Fine aggregates (sand sized) prepared by fly ash

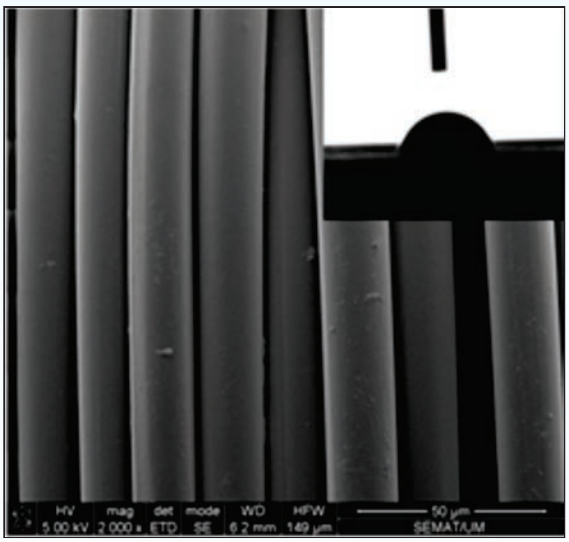
Durable Water Repellent and Stain Resistant Super Hydrophobic Textile Finishes Based on Polymer Nanocomposites

Development and characterization of block copolymers for surface modification in micro fluidics and synthesis of amphiphilic i.e. hydrophobically modified polymers(Surfactants), graft copolymers and sieving matrices and their characterization by GPC, NMR, light scattering, GC-MS and other physical properties studied by viscometry, elipsometry, contact angle confocal microscopy.

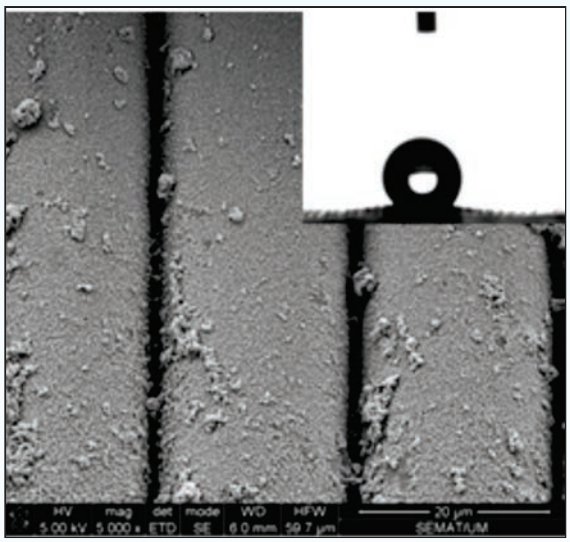
Development of ZnO-PMMA nanocomposites and its application on polyamide fabrics to impart superhydrophobicity and UV protection functions. The ZnO-PMMA nanofinishing on fabric proved to have better UV protection property than the untreated fabric. The broad band absorption of detrimental UV radiation and high transmittance of natural visible light make the ZnO-PMMA nanofinishing a very efficient UV protection for the UV shielding polyamide fabrics.

Combination of low surface energy PMMA and nanosize ZnO in ZnO-PMMA nanofinishing on polyamide fabrics provides superhydrophobicity. The results provided a very easy and economical method for fabricating super hydrophobic polyamide fabrics. The superhydrophobicity of the fabric is achieved even at low concentration of 0.1% of ZnO in the polymer nanocomposite.

In another part our research work, we demonstrated that an excellent surface modification can be achieved by adsorption of copolymers as stabilisers on activated silica surface.High performance polymers exhibiting multifunctional characteristics can be achieved by the introduction of inorganic nanoparticles like SiO_2 in to the functional polymers. The results also show the newly synthesized polymer disperse the nanoparticles well as evidenced by SEM analysis, the uniformly dispersed SiO_2 nanoparticles in the polymer matrix and the particles almost remained in their original shape and size even after incorporation in to the polymer matrix.



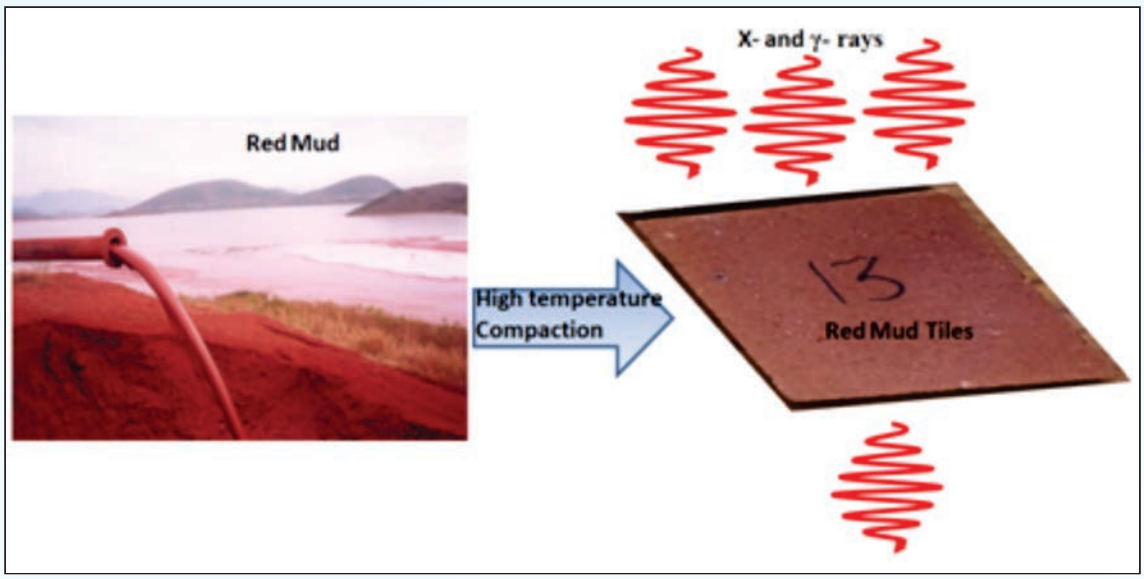
SEM micrograph of the untreated polyamide fabric



SEM micrograph of polyamide fabric (Inset : contact angle measurement showing superhydrophobicity)

High Density Radiation Shielding Red Mud Tiles by Adding High Dense and High Z Materials with Red Mud and Subsequent Sintering.

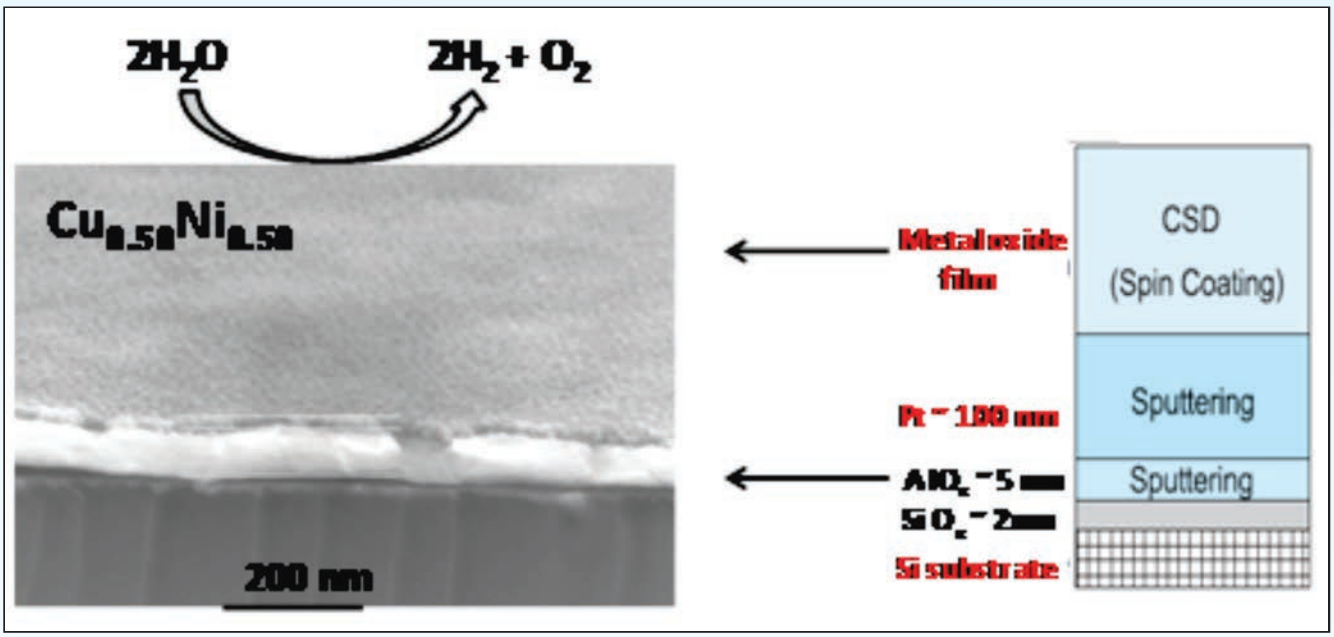
Red mud is one of the industrial wastes which are currently dumped in artificial lake and sea. It eventually, leaches out and pollutes the soil and ground water. Since red mud contains a lot of iron (Fe) which is capable of shielding X-and gamma ray photons, we are working on the fabrication of high dense sintered red mud tiles by adding high Z materials like Bi_2O_3. The main aim of adding Bi_2O_3 (8.9 g/cc) is to synthesize high dense $Bi_{12}SiO_{20}$ (= 9.2g/cc) and $BiFeO_3$ (8.33g/cc) phases upon sintering. At ≈825°C, Bi_2O_3 can react with less dense SiO_2 (2.17g/cc) and Fe_2O_3 (5.27g/cc) present in the red mud and form high dense $Bi_{12}SiO_{20}$ and $2BiFeO_3$ phases, respectively. Eventually, it can help to increase the density of red mud tiles >5.5g/cc. In addition, partially melted red mud tiles will be compacted at high temperatures to close its pores and thereby to increase its density. The successful end of this project could help to replace the currently used few meters thick concrete walls with few cm thick red mud tiles to attenuate high energy photons. Moreover, it will assist to suppress the accumulation such noxious materials and their associated problems.



Electrocatalytic Water Oxidation using Cheap and Abundant First Row Transition Series Metal Ion

Hydrogen produced by electrochemical water splitting provides a promising path to produce a clean energy source. Molecular hydrogen has the potential to replace the global energy dependence from the traditional fossil fuels to sustainable and clean energy source. For the large scale production of hydrogen, the key factor is the efficiency. The electrochemical water splitting process involves the oxygen evolution reaction at the anode and the hydrogen production reaction at the cathode. Although, in this process, the hydrogen evolution reaction is of major interest, it is the anodic oxygen evolution reaction that hampers the efficiency of the overall water splitting reaction. This challenge can be overcome by developing appropriate catalysts that

can drive the overall water splitting process at lower overpotentials. Currently, precious metal ions like Ruthenium and Iridium oxides are the best known water oxidation catalysts, but they are economically viable and also present in limited amount. Efforts are in progress to develop catalyst from first row 3d transition series metal ions specifically Co, Ni, Mn and Fe. Though significant progress has been made, still substantial work needs to be done to develop the catalyst that not only be made of earth abundant metal ions but should also have the improved activity.



Spin Coated Mixed Copper-Nickel Mixed Oxide on the Platinised Silicon Substrate with Alox as Adhesion Layer as Efficient Electro-Catalytic Water Oxidation Catalyst.

Among the first row transition series metal ions copper based catalysts have been known to play an important role in various biological oxidation reactions. Compared to other 3d transition series metal ions copper based electrocatalysts are still not so well explored for the oxygen evolution reaction. Beside this, almost all of the work is performed on electrodeposited films. Electrodeposition is a user friendly and cost effective method but often suffers from films with poor reproducibility and non-uniform structure. Beside this, it is very difficult to produce films with different composition. It has been reported that mixed oxides possess higher catalytic activity compared to respective single component oxides. Mixed oxidation states of the cations may increase the electrical conductivity that enhances the adsorption of the reactant and thereby facilitate the catalytic activity.

We developed a facile chemical solution deposition method for the deposition of copper and copper-nickel mixed oxides for the electrocatalytic oxygen evolution reaction. It was found that presence of both metal ions in equal proportion results in maximum activity. These results indicated that the both the metal ion show the synergistic effect during water oxidation reaction. Various spectroscopic studies revealed that the presence of copper in the film tend to promote the formation of nickel layered hydroxide and thereby play an important role in improving the kinetics of the oxygen evolution reaction. Chemical solution deposition process results in uniform distribution of both the metal ions in the deposited films. Beside this the suitable electron affinity of the chosen metal ions results in the synergy between them in presence of applied potential facilitating the formation of catalytically active phase.

Advanced Geopolymeric Coating Materials for Protection of Corrosion of Mild Steel Substrate

Mild steel is used as structural steel in pipes, wire, marine applications, nuclear powered transportation, fencing, metal-processing equipment's etc. all over the world. It is subjected to adverse environmental conditions which causes corrosion and resulting in decrease in life of mild steel based structures.

Geopolymer coated mild steel tubes and Plate

In order to address this problem, CSIR-AMPRI, Bhopal has developed different compositions of geopolymeric coating material utilizing class F fly ash (chemical composition 59±2% SiO_2, 27±2 Al_2O_3, Fe_2O_3 6.5±2 % , CaO 0.13±0.2%, MgO 0.59 ±0.2% and Na_2O 0.30.2%, K_2O 3.1 ±0.2 %, TiO_2 1.5±0.2 % LOI: 1± 0.2%, amorphous silica content around 31±2 %), alkali activators, additives / organic resin and hardener by novel process (US Patent Application No. 15/461,900 allowed in USA) and coated them on cleaned and treated mild steel plates by spray and paint brush coating techniques. Coated mild steel plates were tested for adhesion strength, high temperature resistance, fire protection, water resistance and corrosion resistance properties. Coated mild steel plates indicated adhesion strength in the range of 2.0 to 3.5 MPa. Developed coating material

compositions were tested for corrosion resistance properties by weight loss method. Inhibition efficiency of coated mill steel plates was found to be around 80 to 85 % and corrosion rate is 3-4 times lower than uncoated mild steel. Electrochemical measurements were performed for testing of corrosion resistance using an anodic polarization method. The small passage of current through geopolymer coated mild steel plates confirms the strong resistance of the coated materials towards corrosion. Accelerated corrosion test was performed in salt spray chamber. Onset of corrosion started after 20 -22 hours confirms again the strong resistance of the coated materials towards corrosion. Thickness of coating was found to be in the range of 90 to 150 µm Results indicated that developed coating material possess promising corrosion resistance characteristics.Material has been demonstrated at NTPC Simhadri site. Successful results have been achieved.Further studies on improvement in coating material compositions with improved adhesion strength and corrosion protection characteristics are under process.

Up Scaling of Technology for Making Advanced Non-Toxic Radiation Shielding Materials of Strategic Importance, Utilizing Industrial Wastes

The project is funded jointly by The Department of Science and Technology (DST) and Council of Scientific and Industrial (CSIR). The project aims to up-scale the technology for development of synthetic radiation shielding aggregates.

The increased power consumption and demand for nuclear power in India has compelled the Government to commission new nuclear reactors in different parts of the country, hence this has increased the requirement of shielding aggregates manifolds.

CSIR-AMPRI, Bhopal has developed a process for development of Radiation Shielding Synthetic Aggregate utilizing Aluminum industry waste Red Mud. The developed aggregates will replace conventionally used hematite ore aggregate being used for making radiation shielding concrete. Theses Red Mud based synthetic shielding aggregates will be utilized for the development of radiation Shielding concrete capable of shielding X-ray and Gamma-rays radiations. The developed Radiation Shielding concrete can have wide applications in various sectors like: Nuclear Power Plants, Bunkers for Strategic Sector, Medical diagnostic installations etc.

By virtue of this, a “Centre for Advanced Radiation Shielding Materials” which is the first of its kind in India is under construction at CSIR-AMPRI, Bhopal.

Advanced Construction Materials Group

The Group aims to develop new range of composites using variety of waste materials viz, marble, granite & stone waste which comes from cutting and grinding and also fly ash which is a byproduct of thermal power plant.

Manufacturing Hybrid Lightweight, High Strength and Glossy Finish, Polymeric Composites from Marble & Granite Waste Stream

Project team has done extensive visits to locations in the state of Rajasthan: Chittorgarh, Rajsamand, Udaipur, Jaipur, Makrana, Kishangarh, and Kota and has collected samples of Marble, Granite and Stone wastes from sites including mining, processing industries and dumping. Soil and water samples have also been collected from areas around these sites. Global Positioning System (GPS) data was studied for all the sample collected at the respective locations. The material was thoroughly characterized after which hybrid polymeric composites which were of glossy finish, lightweight and exhibited high strength made from the collected marble and granite wastes.

Collection of marble slurry waste sample from dumping site in Rajsamand

Fibre and Particulate Reinforced Hybrid Polymeric Composite as Architectural Interior for Building Construction Material

The objectives achieved during 2017-18 relate to (i) development of advanced hybrid green composite wood in pilot scale with glossy finish, varying colours, texture and size after appropriate characterisation in terms of physical, chemical, thermal and morphological properties of marble wastes particulates. As part of the technology licensed to industries, training and technical assistance have been provided for commercialization and (ii) development of anti-termite hybrid green composites using marble wastes particulates with Jute / cotton/ glass fibres in polymeric system followed by testing and characterisation of developed composites.

Pure Granite waste sample being collected at the new dumping site in Kishangarh

The technology details on hybrid green composites were shared and showcased in the workshop on Gainful Utilization of Marble Slurry and other Stone Wastes organized by Centre for Development of Stone, RIICO Rajasthan on 13th July, 2017 at Jaipur and in the IISF at Chennai during 13-17 Oct. 2017. Delivered invited lecture on Swachh Bharat Thematic session on Industrial and Non-hazardous wastes by Ministry of Earth Science and Industry-Academia Interaction Meet during IISF 2017. With the efforts of CSIR-AMPRI the GST Council, Delhi for GST Tax Slab exemption/ tax reduction has considered reduction in the tax slab on on innovative materials of CSIR-AMPRI.

Water Resource Management and Rural Technology Group

The Group has mandate to carry out studies in water resources management. Main capabilities of the Centre exist in Resource Modelling and Analysis. Aim of the group is to apply Scientific and Industrial R & D that maximizes the economic, environmental and societal benefits for the people of the country through Watershed and Wasteland development, Rainwater Harvesting, Water Resources Management, Improvement of Irrigation, Rural Employment, Economic growth of Tribal Community. The activities of group are as follows:

- Soil and Water Conservation, Geotextile applications
- Decision Support System
- Increase in irrigation potential
- Rural Development and Employment Generation
- CSIR-800
- Water Quality and Artificial Ground Water Recharge
- Remote sensing , GIS and GPS applications
- Hydrological and Ground water modeling and Urban Hydrology
- Wasteland Development and Ravines Reclamations
- Creation of Digital database and Thematic Mapping
- Study of Hydrological Big Data

Modeling of Soil Behavior Change Due To Groundwater Level Variation for Rural Water Resource Management

In the study, two sites were selected for instrumentation. One of the selected sites pertains to shallow ground water level (Kesla Khurd) and another site fall within deep groundwater level Dumdum). Both the selected sites are coming under Tawa river catchment area of Hoshangabad district M.P. In each site instruments were installed for regular monitoring of soil moisture / temperature and groundwater level. Also, land surface temperature of the area has been calculated by processing of LANDSAT 8 thermal data (Band 10) during pre-monsoon period (November 2016- April 2017). Relationship among all these calculated parameters have been established to understand the fundamental linkage between these measured parameters with groundwater levels.

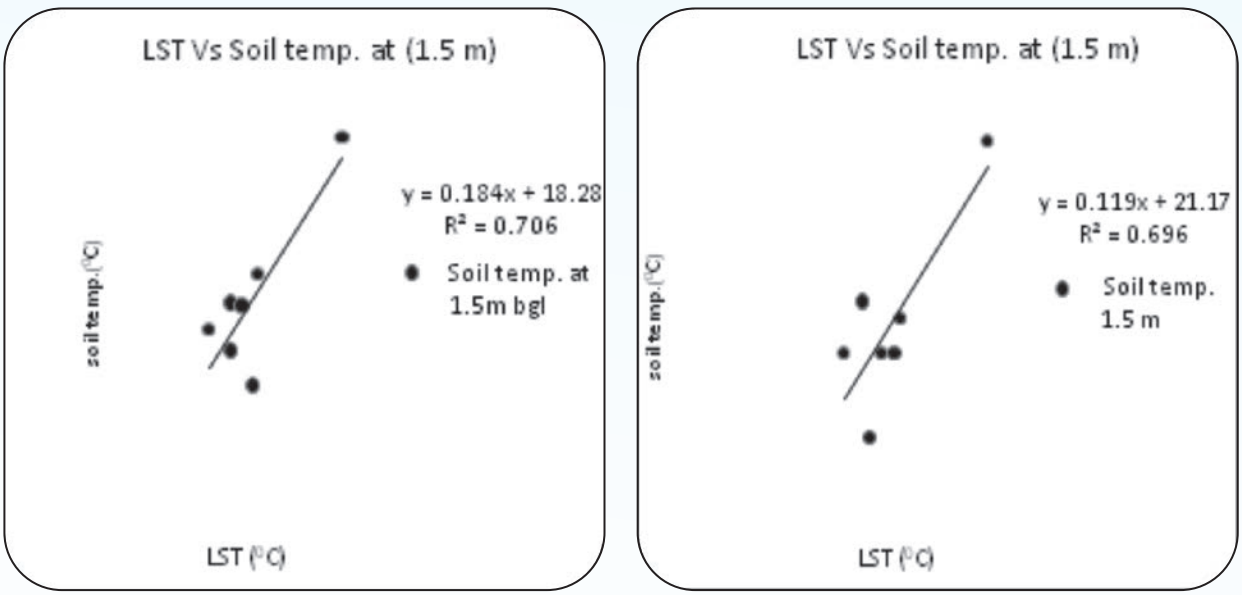
Relationship between land surface temperature (LST) with soil temperature at observation depths of (3, 2.2 & 1.5 m) bgl have been developed. The results have shown that at shallow observation depth a strong positive correlation i.e. R^2= 0.706, 0.674 & 0.562 has been resulted at shallow groundwater site, while on other hand a weak correlation i.e. R^2 =0.696, 0.350 and 0.383 was found in observation depth of 1.5, 2.2 & 3 m bgl at deep groundwater site. Correlation results of LST with soil temperature in different depths i.e. (1.5m, 2.2 m & 3m bgl) are shown in Fig.1 (a-f).

Similarly, relationship between soil moisture and land surface temperature has been ascertained at both test sites. Correlation results of which have shown that a strong negative correlation i.e. R^2= 0.743, 0.649 & 0.431 were found in observation depths (1.5, 2.2 & 3 m bgl) at shallow groundwater site and very weak correlation i.e. R^2= 0.395, 0.504 & 0.076 resulted at deep groundwater observation site Fig.2 (a-f).

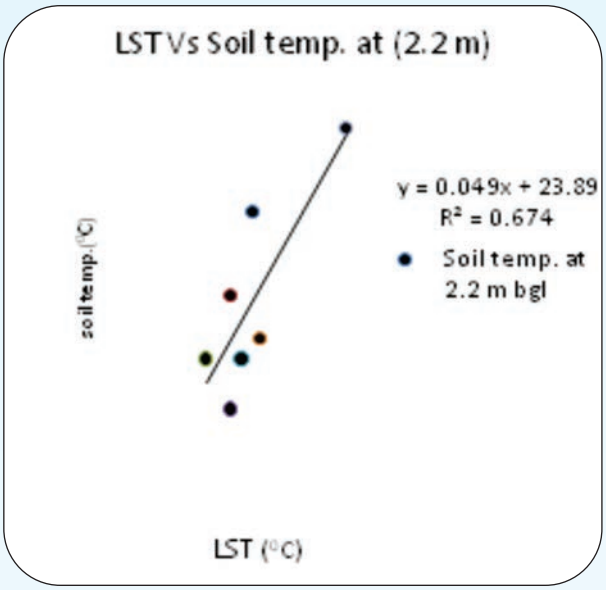
Relationship of land surface temperature with groundwater level has also been developed. Results of which have shown that a strong correlation i.e. R^2= 0.782 & 0.679 has been found at both the observation sites (Fig. 3a&b).

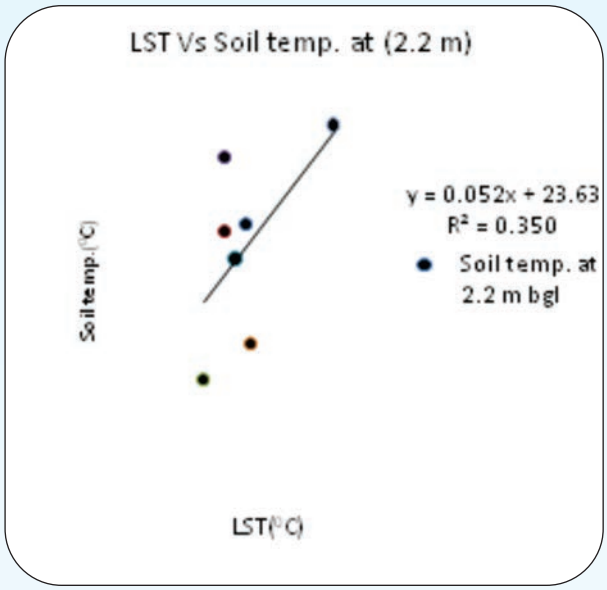
Furthermore, a multi-parameter correlation matrix among calculated parameters was developed, showing the relationship among all these measured parameters each other. With the help of the correlations matrix each observed parameter can be predicted in the field without instrumentation which will reduce our field study, efforts and time. The study has proved that all these physical parameters of the soil are linked each other and any change in one parameter tends to change to other and are very sensitive to groundwater level dynamics.

The study will help in management of irrigation water, irrigation scheduling and prediction of groundwater level. Besides this, understanding the vertical variations of soil moisture / temperature within soil profile will help in groundwater modeling and agricultural studies. Also, applying this new approach for exploration of shallow groundwater formations will inculcate interest among researchers / scientists working in the field of water resources management.

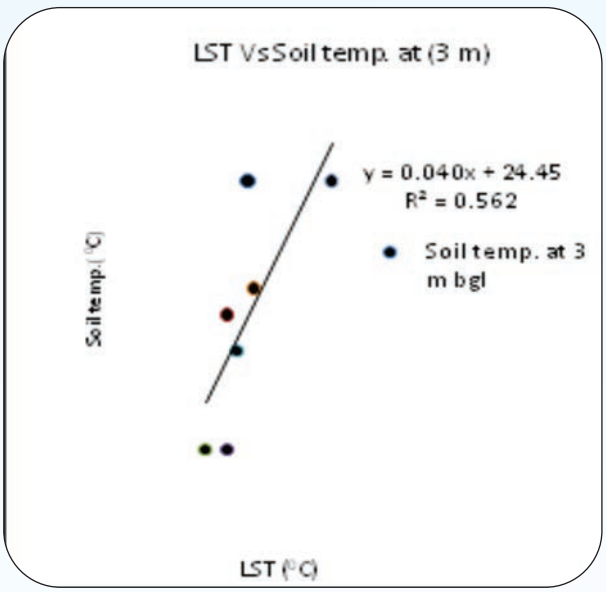


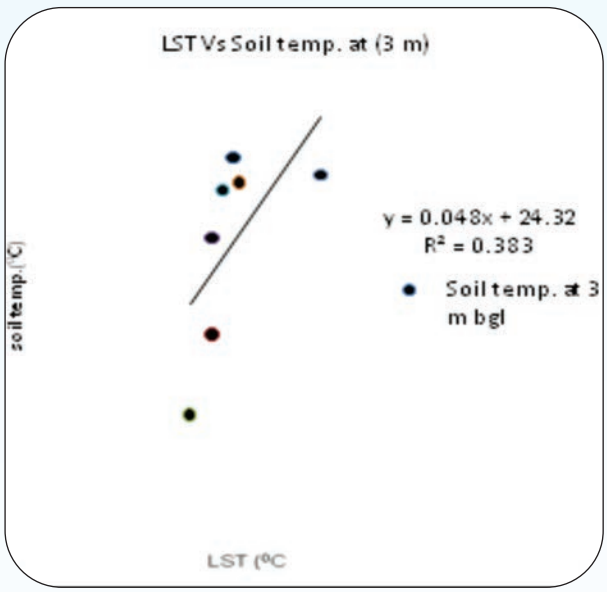
(a) Shallow Groundwater site (Kesla Khurd) (b) Deep Groundwater site (Dumdum)





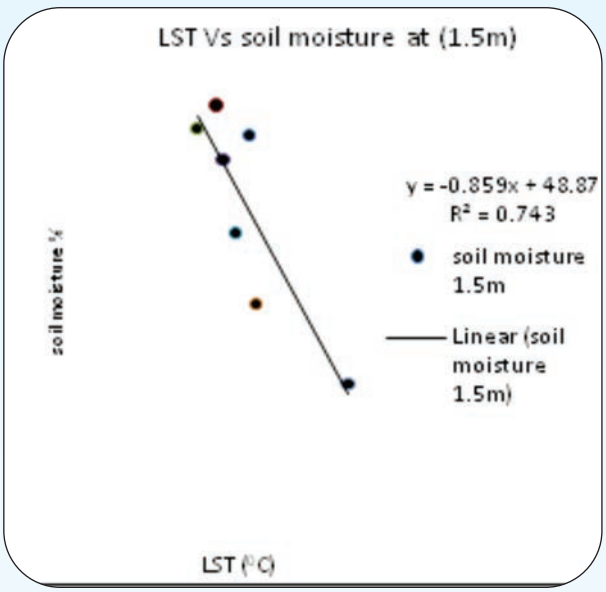
(C) **Shallow Groundwater site (Kesla Khurd) (d) Deep Groundwater site (Dumdum)**

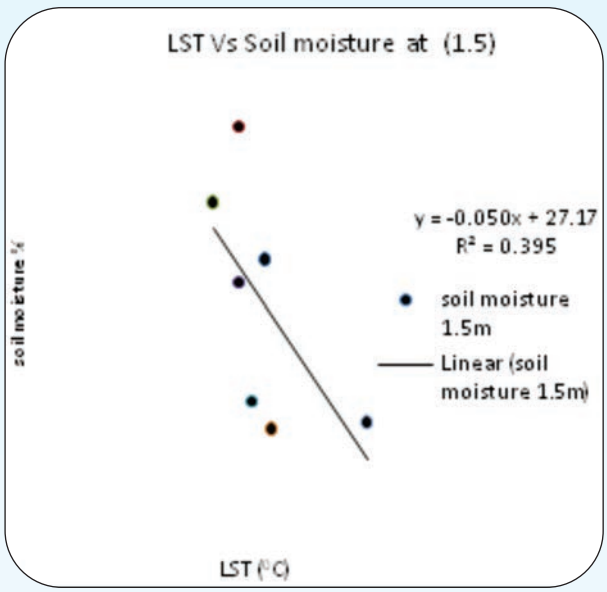




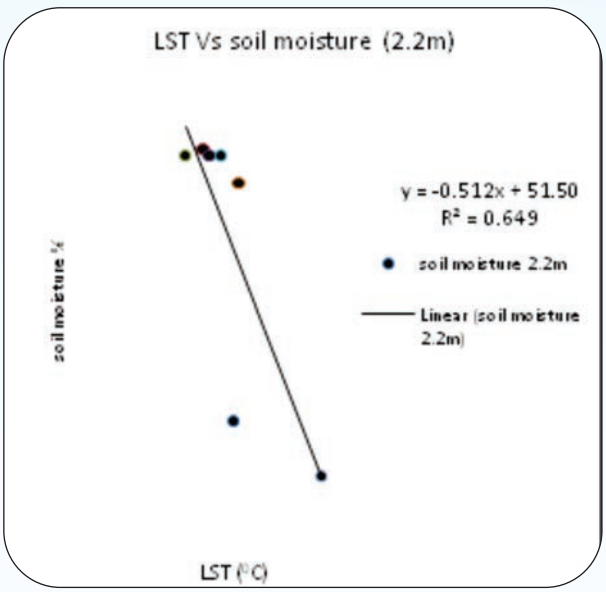
(e) Shallow Groundwater site (Kesla Khurd) (f) Deep Groundwater site (Dumdum)

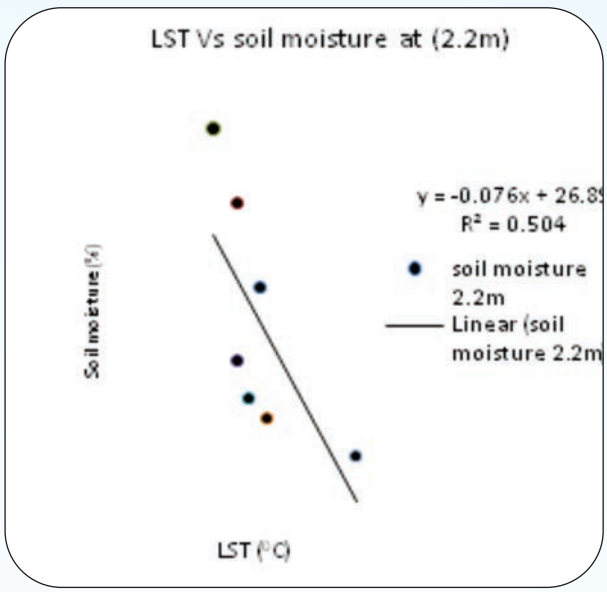
(a-f): Relationship between LST and Soil temperature in observation depths (1.5, 2.2 & 3 m bgl) at Shallow Groundwater site & Deep Groundwater site Kandaihimmat Watershed, Hoshangabad M.P.



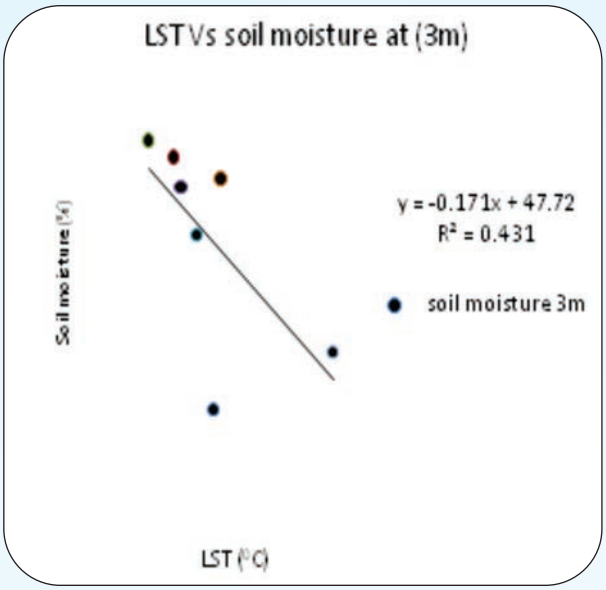


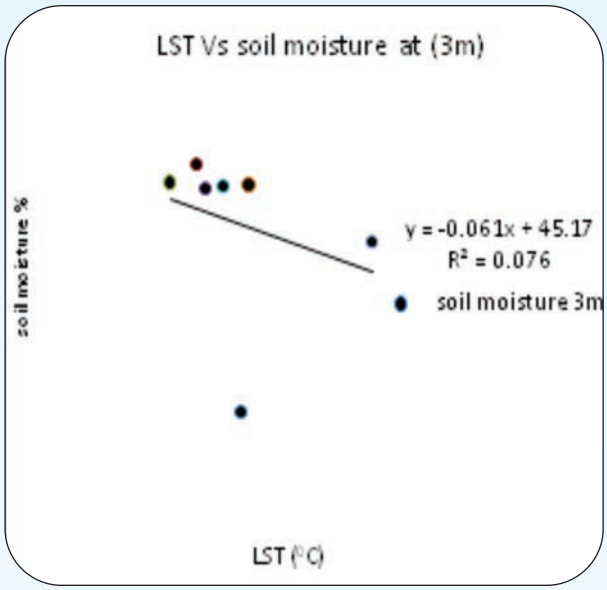
(a) Shallow Groundwater site (Kesla Khurd) (b) Deep Groundwater site (Dumdum)



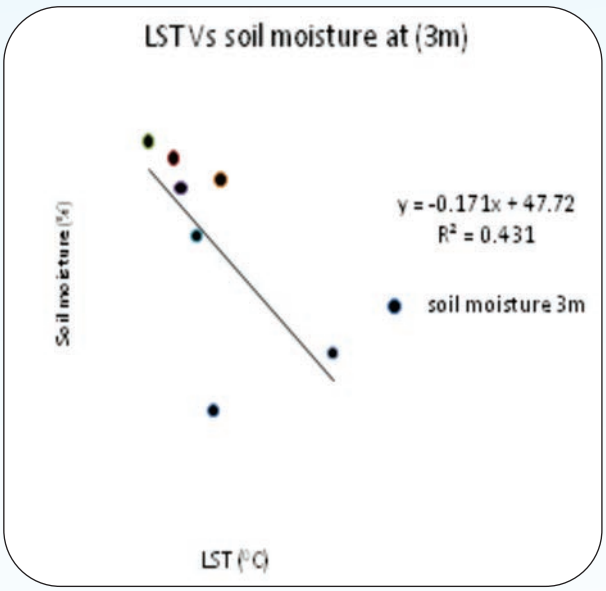


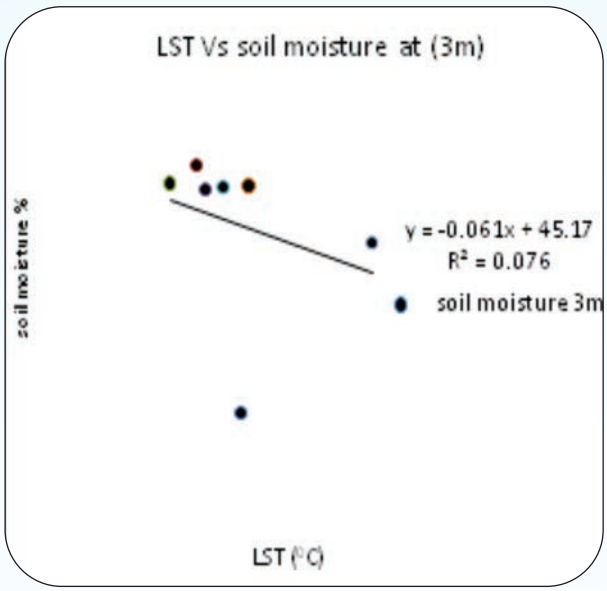
(c) Shallow Groundwater site (Kesla Khurd) (d) Deep Groundwater site (Dumdum)





(e) Shallow groundwater site (Kesla Khurd) (f) Deep Groundwater site (Dumdum) (a-f): Relationship between LST and Soil Moisture in observation depths (1.5, 2.2 & 3 m bgl) at Shallow Groundwater site and Deep groundwater site, Kandaihimmat Watershed, Hoshangabad M.P





(a) Shallow Groundwater site (Kesla Khurd) (b) Deep Groundwater site (Dumdum)

Fig.3: Relationship between Land Surface Temperature and Groundwater level (a) Kesla Khurd & (b) Dumdum site, Kandaihimmat Watershed, Hoshangabad M.P.

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद – भारत
CSIR - INDIA

IMPORTANT EVENTS

CSIR Foundation Day Platinum Jubilee Celebration

CSIR-AMPRI celebrated 76th Foundation Day of CSIR on September 26, 2017. The Chief Guest Shri Dibyendu Sarkar, IAS, Commissioner, Panchayat and Rural Development Department, West Bengal marked his valuable presence on this occasion along with Shri Sibasish Basu, GM (TS) NTPC Farakka. Dr. Rajendra Kumar, Former Director CSIR-AMPRI was the esteemed guests of honour. The event started with the warm welcome of the guests by Dr. S.S. Amritphale, the then Acting Director, CSIR-AMPRI, who also highlighted the achievements of the institute. A brief description of Foundation Day was given by Dr. Rupa Dasgupta, Chief Scientist, CSIR-AMPRI. This was followed by the encouraging words of Dr. Rajendra Kumar, Former Director, who touched upon the achievements of CSIR-AMPRI since its inception. Shri Sibasish Basu made a small presentation on the occasion mentioning the need of collaborative work of NTPC and AMPRI in solving problems related to waste

A view of the dias

A view of the dias

utilization and future scope along with potential application of geopolymeric material for different activities of NTPC. The occasion also included the felicitation of superannuated staff members and those who completed 25 years of their services in CSIR. Prize distribution ceremony was conducted to felicitate and recognize the talent of the staff members, AcSIR students in various academics, arts, sports etc. In his address, the Chief Guest Shri Dibyendu Sarkar congratulated AMPRI for its unmatched work. Dr. S.A.R. Hashmi, Sr. Principal Scientist CSIR-AMPRI proposed the vote of thanks. Convenor and Coordinator of the programme was Dr. S.K.Sanghi, Head, HRDC, CSIR – AMPRI.

The second half was focused on laboratory visit where chief guest and guest of honour visited different sections and laboratories where scientist of different group appraised them about different developmental activities including geopolymeric tetrapod, paver blocks made out of copper tailings, synthetic sand from flyash etc.

Technology Transfer of Radiation Shielding Materials For Broad Application Spectrum

A Know- How Technology on"A novel process for making advanced radiation shielding materials for broad application spectrum" was transferred by CSIR - AMPRI, Bhopal to M/S ASSURAYS, Noida, U. P. on October 24,

2017. The developed advanced radiation shielding materials in the form of panels and tiles can be used in broad application spectrum ranging from diagnostic X-ray and CT scanner room to other strategic radiation shielding installation. Mr. Arjun Choudhary, Director, M/S ASSURAYS said that by utilization of red mud various issues can be successfully addressed, like health care, industrial waste management, unemployment, the source of income generation, cleaner, greener and safe environment.

Technology Transfer

The developed technology basically involves chemically exploring the multi-elemental, multi-component phases genetically present in red mud. The synthesized powders have high density with multilayered, multi-crystal and multi shielding phases necessary for achieving radiation shielding properties.

Technology Transfer of Advanced Pavers Block from Copper Tailings

CSIR - AMPRI, Bhopal transferred the knowhow of making "Advanced Pavers Block from Copper Tailings" to

Technology Transfer

Hindustan Copper Limited, Malanjkhand on May 30, 2017. This knowhow is generated during the research work on the project "Development of Advanced Material Utilizing Malanjkhand Copper Ore Tailings" sponsored by Hindustan Copper Limited, Malanjkhand. Copper Tailing is a waste product of Copper extraction process which is generated in very large quantities and was not being utilized and causing pollution.

The documents were exchanged between Dr. S.S. Amritphale, the then Acting Director, CSIR – AMPRI and Shri ON Tiwari, Executive Director, Hindustan Copper Limited , Malanjkhand in the presence of Prof. J.S. Chouhan, Director, Samrat Ashok Technological Institute, Vidisha.

At the outset Dr. S.S.Amritphale welcomed the guests and highlighted the activities of CSIR – AMPRI. Shri O N Tiwari said that there are heavy metals in the waste of copper smelting which affects the environment. This waste was not being utilized at Malanjkhand since 1982. He appreciated the role of AMPRI to bring this technology of making blocks which can solve the problems of environmental pollution, employment and also helpful at economic level. The blocks are used in the HCL township also, he said.

Prof. J S Chauhan in his address said it is the duty of scientists and educationists to think about the requirements of the society. We have to put emphasis on reduce, reuse and recycle and industries also have to think of reducing pollution.

The Principal Investigator of the project Dr. Mohammad Akram Khan made a presentation on the technology. Dr. S K Sanghi, Head, Publication and Publicity Cell proposed the vote of thanks.

CSIR Platinum Jubilee Techfest Capsule Exhibition

Council of Scientific and Industrial Research organized Capsule Exhibition across the country as a part of the CSIR Platinum Jubilee Celebrations to make the masses acquainted with the contributions of CSIR in various fields. The venue for the 3 day (August 22-24, 2017) exposition was CSIR – AMPRI, Bhopal.

A large number of Students, Dignitaries and entrepreneurs witnessed the display on the achievements of CSIR at one place. The display included early warning system for landslides developed by CSIR–CBRI, Roorkee,

Inauguration of the Exhibition

Student visiting the stalls

Swaraj, Sonalika and Krishishakti, which are very popular tractors of India, developed by CMERI, Durgapur, Amul Milk developed by CFTRI, Mysore using Buffalo milk were few of them.

The exhibition contained the exhibits on the achievements of CSIR in the areas of CSIR – 800(Social Intervention), Nurturing Human Resources, Intellectual Property and Entrepreneurship, Chemical and Petrochemical, Water, Ecology and Environment, Leather, Materials and Minerals, Energy, Healthcare, Aerospace, Engineering and Infrastructure, Agriculture and Floriculture, and Food and Nutrition.

At the Valedictory function, Dr. Sudhir Kumar Goyal, Professor and Head, Deptt. of Biotechnology, AIIMS, Bhopal was the Chief Guest. The Chief Guest visited the exhibition and also witnessed the work done by AMPRI. He, in his address, appreciated the important work done by AMPRI. Dr. SS Amritphale, the then Acting Director welcomed the guests and underlined the technologies developed by AMPRI in the areas of new materials and processes.

He underlined various technologies transferred by the institute to industries for commercialisation. These include Cement Free Concrete, Hammer tips for Sugar Mills, High performance Hybrid Composite Materials , Silicon Carbide Reinforced Composite , Hybrid Wood Substitute Composite Materials(CM- WOOD) , Advanced Hybrid Composite Wood and Wood Substitute Materials(AC Wood) and Knowhow for making the Paver Blocks from Copper Tailings.

Industry Institute Enclave-2017

CSIR- AMPRI & Institute for Environmental Nano technology – Centre of Excellence (IENT-COE) jointly organised one day workshop titled “Industry Institute Enclave (IIE-2017)” to ease the commercialization of CSIR Technologies with a main focus on CSIR- AMPRI's “Advanced Hybrid Green Composites Technology” and “Cement-free Concrete & Radiation Shielding Technology” on August 9, 2017 in Coimbatore, Tamil Nadu. During this workshop various other CSIR Technologies of CBRI, SERC, CGCRI and NPL have also been disseminated and showcased.

The chief guest of the inaugural function Dr. T. Ramasamy, Former Secretary, DST, Govt. of India highlighted the importance of such Enclave to integrate Industries & CSIR, to meet the Nation's expectation. Dr. Muraleedharan, Director, CGCRI in his address emphasized the importance of CSIR technologies for the industries & Society for creating new business. He praised AMPRI's work on utilization of waste materials from various industries. CSIR-AMPRI exhibited hybrid composite materials, prototype product and Sisal fibre technology.

Dr. S.S. Amritphale, the then Acting Director, CSIR-AMPRI delivered lecture on “Cement free geo - polymer concrete & Radiation shielding materials for civil infrastructure.” Dr. Asokan Pappu,Senior Principal Scientist, CSIR-AMPRI, Bhopal made presentation on “Creating new industries & Entrepreneurship for manufacturing Hybrid green Composite materials for housing sector and recycling marble, granite and other industrial wastes.” Other lectures from CSIR-CBRI, Roorkee, CSIR-NPL, New Delhi, CSIR-SERC, Chennai, Nanotech Innovations Pvt Ltd, Bengaluru, Swadeshi Science Movement, Delhi were also presented.

National Technology Day

CSIR-AMPRI, Bhopal celebrated National Technology Day on May 11, 2017 to commemorate the momentus accomplishments of Science and Technology. The day is celebrated every year to commemorate the series of nuclear tests at Pokharan. Subsequently, the firing of Trishul missile by DRDO and launching of HANSA civilian aircraft by CSIR – NAL have marked the Technology Day.

National Technology Day

Er. Arvind Shrivastava,Chief Engineer, Civil Engineering Group, Nuclear Power Corporation Ltd., Mumbai was the Chief Guest and Shri Sanjeev Narvekar, Marketing Manager, Hindoostan Composite Solutions, Mumbai was the Guest of Honor on the occasion. At the outset, Dr. S.S. Amritphale, the then Acting Director, CSIR – AMPRI, Bhopal welcomed the guests and highlighted the activities of AMPRI, Bhopal.

Dr. Rupa Dasgupta, Chief Scientist, CSIR – AMPRI underlined the importance of celebration of National Technology Day. Shri Sanjeev Narvekar delivered the Technology Day lecture on "Opportunities and Applications in Composites" on the occasion. He presented the fascinating scenario of usage of new composites. Er. Arvind Shrivastava, in his address underlined the technological achievements, which are the genesis of Technology Day. He said that scientists should contribute to society with their research work. He also underlined the contribution of AMPRI towards the society through it's time and cost saving technologies. The function concluded with a vote of thanks from Dr. R.K. Morchhale, Chief Scientist,CSIR – AMPRI.

Short Term Course on Computer Simulation: An Industrial Problem Solving Tools for Engineers

FEM simulation and modeling is an important tool in solving industrial problems, such as material selection, design of component, finalizing process parameters of any manufacturing process, maintenance of plant, failure investigation etc. It reduces the cost and time while arriving at the solution of any industrial problem. It has been successfully applied in many Engineering fields. Developing understanding of FEM simulation enhances the expertise of Mechanical and Civil Engineers to be able to become a successful professional.

A five days Short Term course was organized during 11-15 SEPTEMBER, 2017 for Engineers, Faculty and Industrial professionals to provide them an opportunity to understand the application of Computer simulation and FEM in understanding the materials behaviour, Optimize various manufacturing processes, failure

investigation and Fatigue and fracture performance evaluation of material as well as components. The participants had also come to know how to use computer simulation at design stage, manufacturing stage, during maintenance and also in case of failure occurs in component.

Topics that were covered in the course - FEM theory and formulation, Input importance and Result Assessment, Simulation of Manufacturing processes, Electromagnetic Forming Simulation, Simulation of Casting Processes, Strength evaluation of brick-infilled RCC frame (Brittle Material), Evaluation of Fatigue and Fracture Parameters, Life Estimation of Component, Failure Investigation of Component and Getting

The Workshop in Progress

Acquaintance with FEM software (ANSYS and ABAQUS)

The expert personnel from renowned industries like fiat chrysler automobiles, and Andritz hydro also delivered invited lectures during the course. The participants attended this course were from industries, faculty from engineering college and Ph.D. research scholars.

Workshop on Technologies for Emerging Materials

The workshop was jointly organised by CSIR-AMPRI and Bhopal Chapters of MRSI, IIM, and TSI, Bhopal, February 15, 2018.

Mini Ice Age is expected shortly within next 20 years and new materials that can withstand those conditions need to be developed immediately. Dr. S. K. Khanna, Director, Midwest Industrial Assessment Centre (MIAC), University of Missouri, Columbia, USA spoke during Workshop on "Technologies for Emerging Materials" held at CSIR-AMPRI, Bhopal. Dr Khanna was presenting technical paper on transparent FRP material having high damage resistance.

Dr. Avanish Kumar Srivastava, Director, CSIR-AMPRI highlighted the aspects of modern methods of materials characterisation including Scanning Electron Microscopy, Transmission Electron Microscopy and Helium Ion Microscopy as high resolution systems used for material characterization.

The Workshop in progress

Dr. N. Sathish, Sr. Scientist gave a lecture on Graphene and Graphene reinforced Composites. Dr. Meraj Ahmed delivered a lecture on Impulse Metalworking: Futuristic Forming and Joining Technique. Dr S A R Hashmi emphasised on development of new technologies that can fulfil the aspirations of people. Dr S. Murali introduced the invited Guest Dr S. K. Khanna and Dr Sanjay Panthi gave the vote of thanks.

Seminar on 'Future of R&D in Materials & Processes: Through the Minds of Young Scientists'

To commemorate the conclusion of CSIR's Platinum Jubilee celebrations, CSIR-AMPRI Bhopal organised a Seminar on 'Future of R&D in Materials & Processes: Through the Minds of Young Scientists' on September 26, 2017. CSIR-AMPRI Bhopal has directed its R&D in the area of advanced materials and processes; materials here include mainly metallic, polymeric and ceramic .

In order to know the floating ideas in the minds of the Scientists recruited at CSIR-AMPRI in the recent past, this seminar was organised. They presented their views on areas which are currently being pursued or thought of across the globe and they would like to pursue at CSIR-AMPRI in the near future. This seminar will help them concretise their ideas and may lead to new areas of research for CSIR-AMPRI in the future.

Institute - Industry Integration – 2018

CSIR-AMPRI, Bhopal, IWST and IPIRTI, Bangalore have developed several technologies for manufacturing advanced materials using agro-industrial wastes, natural fibres and polymer as a hybrid green composite materials. These composite materials are stronger, durable, environmental friendly, cost effective and have ample scope for variety of applications in building construction and housing sector. The agro-industrial waste based polymer composite materials are stronger than natural wood, synthetic wood, and plastic, interns of it quality and cost effective. The innovative composite materials can be used for variety of applications such as doors, false ceilings, roofing, flooring, partition and furniture.

In this context, an INSTITUTE - INDUSTRY INTEGRATION (III-2018) workshop was organized on January 19, 2018 at IWST Bengaluru to ease the commercialization of recently developed innovative technologies. The III-

2018 was organized by CSIR-AMPRI, Indian Plywood Industries Research & Training Institute (IPIRTI) and Institute of Wood Science and Technology (IWST), Ministry of Environment and Forest, GoI leading to create more business opportunities for existing industries, start-up industries, entrepreneurship as well as a sustainable source of income to the society. About 85 delegates from industries (wastes producers & users), entrepreneurs, startups, wood and composites manufacturers, architects, builders, user agencies participated in this event.

The program was inaugurated by the chief guest, Mr. Darpan Jain, Commissioner for Industrial Development & Director of Industries & Commerce, Govt. of Karnataka. Mr. Jain, in his address, expressed that III-2018 was a unique platform to bring lab research into industrial applications to benefit the society. He proposed few very important schemes such as (i) Set-up incubation facilities for the mentoring startups, (ii) creation of a cluster development program, (iii) providing marginal monetary assistance for mentoring program, (iv) Skill development program, (v) Identification Geo-indicator resources and requested the R&D institutes and industries to address these challenges for which he would extend financial and all other needful supports.

The guest of honour, Dr. K. Muraleedharan, Director of CSIR-Central Glass and Ceramic Research Institute (Kolkata), in his address, conveyed to industries to come up with their specific challenges which can be resolved by R&D institutes. Mr. Anil Uppin, Managing Director, Karnataka Council for Technological Upgradation, in his address, emphasized that there is huge availability of agro wastes (mainly paddy and maize waste) in the state and urged R&D institutes and industries to come up with innovative and sustainable solutions for utilization of these wastes.

During the program Dr.Avanish Kumar Srivastava, Director CSIR-AMPRI, Mr. Surendra Kumar (IFS), Director, IWST, Dr. B.N. Mohanty (IFS), Director, IPIRTI also spoke on the importance of III-2018. They emphasized that there is a need of interface between institutes and industries for effective re-use of industrial wastes, agro-wastes and realization of all recent technologies of all three institute by industries is expected to result a new class of advanced composites to the society contributing to Make in India, Clean India and Skill India Mission programmes. Also, they have stated that these technologies would lead to employment & income generation both in rural and urban areas.

Scientists from CSIR-AMPRI, IWST and IPIRTI delivered presentations of readily marketable technologies of respective institutes. This includes CSIR-AMPRI technologies- Hybrid green composite materials from industrial wastes, Geo-polymer concrete & Radiation shielding materials and Aluminium foams for transportation and construction sector. The event oversaw a very fruitful panel discussion chaired by Dr. N. Gopalakrishanan, Director, CSIR-CBRI during which several constructive ideas and dialogues were exchanged. Dr. Gopalakrishnan stated that there are several marketable technologies available in CSIR system and requested industries and delegates to visit and realize optimum benefits.

The delegates from industries stressed development of technologies that have lower cost and reduced carbon footprint. There was mutual consensus on integration of R&D, regulatory network, government support, acceptability by the industry, incentives to entrepreneurs and startups so that innovative technologies can quickly reach out the industry and society. To introduce any new technologies to industry or society, it was felt that connecting R&D institutions with industry under Government schemes found very important for actual speedy implementation and optimum mutual benefits.

An exhibition was organized on the occasion in which technologies of all the three institutes were showcased.

Release of proceeding of III-2018

Dr. Avanish Kumar Srivastava, Director, CSIR-AMPRI address the function

Product Launching of Hybrid Green Composite Materials

A new cla ss of hybrid green composite materials were launched to the society on January 29, 2018 at CSIR - AMPRI, Bhopal in the presence of Prof. Vikram Kumar, Hon's Professor, IIT, Delhi and former Director of SSPL (DRDO) and Director, CSIR-NPL New Delhi, Dr.Avanish Kumar Srivastava, Director, CSIR – AMPRI, Bhopal and Shri P.R. Chauhan, the CEO of M/s. Sidhhi Poly Matrix, Maharashtra.

In the programme, at the outset Dr.Avanish Kumar Srivastava, Director, CSIR – AMPRI welcomed the guests and highlighted the event. Prof. Vikram Kumar in his address appreciated the technology and congratulated AMPRI on the occasion. Shri P.R.Chouhan highlighted the qualities of the product. Dr. P. Asokan, Sr. Principal Scientist, AMPRI proposed the vote of thanks.

CSIR- AMPRI, Bhopal has developed a new class of hybrid green composite material, which is free from termite, fungus, insects, corrosion, fire and and moisture attack. The major raw materials required for manufacturing these materials are natural fibres, polymer and industrial waste particulates such as marble wastes or thermal power plant fly ash or aluminium industry bauxite residues.

The innovative composite materials have showed variety of applications potential for use as doors, false ceiling, floors tiles, wall tiles, partition and furniture. As compared to teak wood, the hybrid green composite materials are almost four times stronger and about 40% cheaper in price. These are highly durable, environmental friendly, and have ample scope for use in variety of multifunctional applications in housing, construction and civil infrastructure. Realization of this technology is expected to contribute to Make in India, Clean India, Skill India Mission Programmes followed by creating employment and income.

With the directives of Government of India and the Director General, CSIR, this technology now has overcome all issues pertaining to weight, price, aesthetic and other properties and is ready for commercialisation internationally. It is a wonder material to replace teak wood, natural wood, synthetic wood

such as MDF, particle board, new wood and ply wood.

The hybrid green composite technologies have been licensed recently to three industries on non exclusive basis in India namely: (i) M/s. Siddhi Poly Matrix, Maharastra, (ii) M/s. VSM Industries, Gujarat and (iii)

The Hybrid Green Composite Product Launch

M/s. Eco-Bright Sheet Co. Pvt. Ltd., Bhilai, Chhattisgarh for commercial production. One of the industries, M/s. Siddhi Poly Matrix, Chandrapur, Maharashtra has started the production on commercial scale. The other industries are setting up the commercial plants and commercial manufacturing is expected soon.

The materials have showed superior performance than conventional plywood in terms of mechanical strength, glue adhesion, finishing and other relevant properties and attract more industries for commercialisation. As per BIS guidelines (BIS IS:303:1989), the test results showed that the CSIR-AMPRI hybrid green composites absorbs less than 0.3 % moisture and resists and avoid fungus, termites and insects attack, whereas commercially available wood and synthetic wood absorbs 5-15 % moisture. The mechanical strength of the material is also far better than the traditional materials. Apart from performing complete tests at CSIR-AMPRI Bhopal, all these tests have been validated by a third party (Cali Lab, Bhopal) on the guidance of BIS authority.

Knowhow Transfer of Nanoadsorbent Based Domestic Filter

CSIR –AMPRI, Bhopal transferred the technology of nanoadsorbent based Fluoride and Arsenic removal filter for from drinking water to M/s MW Social Enterprises Private Limited, Indore on January 01, 2018. Long term consumption of water containing excessive fluoride causes fluorosis that affects teeth, bones, joints and ultimately leads to crippling of the body. Similarly, consumption of high arsenic contaminated water results in

Transfer of Technology

arsenicosis, which start cancerous effect to skin and other soft organs in the human body. More than 100 million people are suffering from fluorosis and arsenicosis problems in different parts in India. Many technologies have been developed for the treatment of drinking water, but none could solve this problem for providing safe drinking water to at household level. CSIR-AMPRI is working on the development of nanoadsorbent based filter useful for arsenic and fluoride removal at household level and has developed this technology successfully. After technology transfer it is expected that millions of life will be saved from fluorosis and arsenicosis problems. The developed nanoadsorbent based defluoridation domestic filter can work without electricity with 1 - 3 liter per hour filtration rate. Methodology based on nanocoating for the incorporation nanoadsorbent in to the sediment removal filter is a new concept in order to provide simple filtration device at household level. CSIR – AMPRI has also succeeded the synthesis of low cost nanoadsorbent (~600 INR/kg). Because of regeneration quality of the nanoadsorbent, fluoride and arsenic adsorbed saturated filter can be regenerated three to four times. This will reduce the treatment cost substantially. After three times regeneration, treatment cost of water is estimated to be around 15-20 paisa/lit for fluoride removal and 4-5 paisa/lit for arsenic removal. The treatment cost of higher fluoride (3 ppm and above) and arsenic (50 ppb and above) containing water may increase in the same ratio further depending total dissolved solid and pH of water. The developed filter is user friendly as one has to simply pour contaminated water in the overhead tank attached to nanoadsorbent containing filters and get fluoride/arsenic treated water from the outlet of the filter. Treated water is free from any secondary contamination and maintain all desirable minerals of water as per BIS.

At the outset of the function, Dr AK Srivastava, Director, CSIR – AMPRI, Bhopal highlighted the achievements of the Institute. He said that AMPRI will be putting every effort for dissemination of its technologies to the users. Dr. I.B. Singh, the inventor of the technology, presented the salient features of the technology.

Sh. Mankaj Kumar Singh, Director, MW Social Enterprise Pvt. Ltd. In his address said that AMPRI has an understanding of technology and expressed happiness over this collaboration. Dr. S.K.S. Rathore, Sr. Principal Scientist proposed the vote of thanks.

Skill Development Programme

A Skill development program has been taken up by CSIR-AMPRI under the flagship scheme of the Ministry of Skill Development and Entrepreneurship. The aim of this program is to enable a large no of Indian youth to take up industry- relevant skill training that will help them in securing a better livelihood. To fulfill the same AMPRI has started with 10 skill programs to make the youth friendly with processing industries and techniques involved.

Skill Development Programme

The different training programs are - CNC Turning, Heat Treatment of Steel and Aluminum Alloys, Metallographic Polishing and Characterization, Mechanical Testing, Surface Modification for Improved Life and Performance of Components, Rapid Prototyping of 3D Design/ Modelling, Introduction to Engineering Drawing, Electroplating, Data Entry Operator and Watershed Management.

CSIR-AMPRI, Bhopal has undertaken skilling/training programmes under CSIR Integrated Skill Initiative which are Fee based, Sponsored by industry/Govt, etc. During 2017-18, a total of 173 candidates have been trained.

The trainings were completed during the session 2017-18 as follows

S.No	Skill/Training Program Name	Duration	No. of people trained
1.	Computer Simulation: An Industrial Problem Solving Tool for Engineers	11/09/2017 to 15/09/2017	16
2.	CNC Turning Operator	19/02/2018 to 16/03/2018	01
3.	Heat treatment of steel and aluminum alloys	14/03/2018 to 13/04/2018	01
4.	Mechanical Testing	26/02/2018 to 23/03/2018	01
5.	Demonstrations of Institute Technologies and Equipments Functioning to theStudents from Technocrats Institute of Technology & Science, Bhopal	16/02/2018	81
6.	Demonstrations of Institute Technologies and Equipments Functioning to theStudents from Lakshmi Narain College of Technology, Bhopal	20/02/2018	63

Jigyasa Programme

As a significant milestone event, Council of Scientific and Industrial Research (CSIR) has signed the Memorandum of Understanding (MoU) with Kendriya Vidyalaya Sangthan (KVS) on 06 July 2017 to launch "**Jigyasa**" programme in the gracious presence of Honáble Minister of HRD and of Honáble Minister for Science & Technology and Earth Sciences, and Environment, Forest and Climate change. Jigyasa envisages a wide ranging Scientist -Students Connect programmes as per various models proposed in the MoU.

A School Connect programme was organsied in the pilot scale during the summer vacation period (May - July, 2017) for a period of 3-5 days .The success of this programme has given a significant impact on the students and teachers. As a result, CSIR and KVS signed a MoU targetting at enhancing 'Scientific Temper' of the school children. The programme has also received positive response from highest leadership for its "Scientific Social Responsibility".

The aim of this MoU is to connect CSIR institutes with school students to develop 'Scientific temper' in the young minds. The scientific temper define as a mechanism wherein students capabilities to use scientific methods which include questioning, observing physical reality, testing hypothesizing, analysis, and communicating are enhanced. This will help in nurturing scientific quotient of the students.

Teachers at the Training

Dr. Avanish Kumar Srivastava giving away the Certificates

The scope and models of management of Jigyasa are CSIR Foundation Day, Environment Day, World Health Day, National Science Day, International Day of Chemistry, National Technology Day, Lab Specific activities/ Onsite experiments, Visits of scientists to Schools/Outreach Progrmme, KVs Hosted within CSIR, Popular Lecturer Series/ Demonstration Programme at School, Student Apprenticeship Programme, Science Exhibitions, Project of National Children's Science Congress, Science and Maths Club, Scientists as Teachers and Teachers as Scientists , Teachers Workshop, Students Residential Programmes, Publication of Student Articles in CSIR Journals, Summer Vacation Programmes etc.

Demonstration of product development

Kendriya Vidylaya's Science Teachers from Bhopal, Guna, Dewas, Amla, Ujjain, Raisen, Vidisha, Ratlam, Itarsi, Mandsaur, Gwalior, Khandwa, Pachmarhi, Mhow, Barwaha, and Neemach districts of Madhya Pradesh have participated.

Agreement with Barkatullah University

CSIR - AMPRI and Barkatullah University, Bhopal have entered into an agreement on Jan 25, 2018 for

Signing the Agreement

enhancing science environment in the country. The area of mutual interest involves Applied Chemistry, Chemo – Information, Civil Engineering, Computer Engineering, Bioscience & Environmental Science, Applied Physics & Nanotechnology, Electronics and Communication, Remote Sensing, Electrical Engineering, Mechanical Engineering, Robotics and Rural Technology. The understanding also has component of exchange of faculty, skill development activities, students exposure. Further, it also includes joint research project proposals, organization of Seminars/ Symposia / Conferences etc.

Vigilance Awareness Week

Vigilance Awareness Week was celebrated at CSIR – AMPRI, Bhopal during 30.10.2017 to 04.11.2017. Oath was administered to the staff members. Essay and Slogan competitions for the staff members and debate competition for school students were organized on this occasion. The staff also undertook e-pledge. Shri Pankaj Jha, DGM (Vigilance), Bharat Heavy Electricals Limited, Bhopal was the Chief Guest at the valedictory Function. He made a presentation on the Vigilance Awareness and gave away the prizes to the winners of the competitions.

Programme on Vigilance and Tendering Process

A one – day programme on Vigilance and Tendering Process was organized by CSIR – Human Resource Development Centre, Ghaziabad at CSIR – AMPRI on March 21, 2018. At the outset Sh. Y Ramakrishna, Sr. Controller of Administration welcomed the guests. Dr. Avanish Kumar Srivastava, Director, CSIR – AMPRI highlighted the importance of such programmes on vigilance. Dr. Nadir Sheikh, Principal Scientist, CSIR – HRDC, Ghaziabad underlined the objective of the workshop. Lectures were delivered by Sh. K.S. Samarendranath,

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Formre Director, Ministry of Steel and Sh. Sanjay Aggarwal, Director, Procurement Policy, Ministry of Finance, Department of Expenditure on Conduct Rules and Public Procurement. Sh. R.N. Waghmare, Administrative Officer proposed the vote of thanks.

Mou Between AMPRI and RRCAT, Indore

An MOU was signed between CSIR-AMPRI, Bhopal and RRCAT, Indore on 20.09.2017. Dr. P. Ganesh, Scientific officer (G), Materials Engineering Section, RRCAT Indore was present at AMPRI for Signing MoU which is titled "Development of solid-state magnetic pulse welding technique for materials of interest in accelerator program". The aim of the MoU is to work on development of solid state magnetic pulse joining of material like SS-Nb, SS-Ti and SS-Cu.

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CSIR - INDIA

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Uppal Road, Hyderabad – 500 007.

Prof. Santosh Kapuria — Sister Laboratory
Director
CSIR - Structural Engineering Research Centre (SERC)
CSIR Road, Taramani
Chennai – 600 113.

Prof. B.K. Mishra — Cluster Director
Director
CSIR - Institute of Minerals & Materials Technology (IMMT)
Bhubaneswar – 750 013.

Dr. S. Das — Director
Director
CSIR-Advanced Materials and Processes Research Institute
Hoshangabad Road, Habibganj Naka
Bhopal – 462 026.

Head or his Nominee — Permanent Invitee
Planning & Performance Division
Council of Scientific and Industrial Research
Anusandhan Bhawan
2, Rafi Marg
New Delhi –110 001.

Management Council

(From 01/01/2016 to 31/12/2017)

Director	Chairman
Dr. Satanand Mishra, Scientist	Member
Dr. N. Sathish, Senior Scientist	Member
Dr. Md. Akram Khan, Principal Scientist	Member
Dr. Rupa Dasgupta, Chief Scientist	Member
Dr. J. P. Pandey, Senior Technical Officer (3)	Member
Dr. K. Muraleedharan, Director, CSIR-CGCRI, Kolkata	Member
Dr. J. P. Barnwal, Chief Scientist & Head, PPD	Member
CoFA/FAO	Member
Sr.COA/COA/AO	Member-Secretary

01/01/2018 - 31/12/2019

Director	Chairman
Dr.S.A.R.Hashmi, Sr.Principal Scientist	Member
Dr.P.Asokan, Senior Principal Scientist	Member
Dr.Meraj Ahmad, Scientist	Member
Dr.Deepti Mishra, Principal Scientist	Member
Dr.Edward Peters, Senior Technical Officer(3)	Member
Dr.Rakesh Kumar, Director, CSIR-NEERI, Nagpur	Member
Shri A.K.Goel, Head ESD,CSIR Cx, New Delhi	Additional DG's nominee
Head ,RPBD/PME	Member
CoFA/FAO	Member
COA/AO	Member-Secretary

Research Publications

1. Rupa Dasgupta, Ashish Kumar Jain, Shahadat Hussain, Abhishek Pandey and V. Sampath, Effect of Alloying Additions on the Properties Affecting Shape Memory Properties of Cu–12.5Al–5Mn Alloy, 2017, Springer Nature : Frontiers in Materials Processing, Applications, Research and Technology Series, Singapore, Chapter 33, November 2017, 377-390.
2. Mohammad Ayub Ansari, Ashish Kumar Jain, Rupa Dasgupta, Effects of quaternary alloying additions on the behaviour of Cu-12.5Al-5Mn alloy, 2017, Materials Today: Proceedings, 4 (2017) 9408–9412.
3. M. Sharma, G.K. Gupta, R. Dasgupta, M. Kumar, P. Kumar, Titanium Foams Processed Through Powder Metallurgy Route Using Lubricant Acrawax as Space Holder Material, Trans Indian Inst Met (2018). https://doi.org/10.1007/s12666-018-1324-x.
4. Rahul Gupta, Sanjay Srivastava, Sanjay K. Panthi, Nand Kishor Kumar, Multidirectional Forging of High-Leaded Tin Bronze: Evaluation of Corrosion Behavior in Aqueous NaCl Solution, Metallography, Microstructure and Analysis, Springer, February 2018, Volume 7, Issue 1, pp 11–25.
5. Rahul Gupta, Sanjay Srivastava, Sanjay K. Panthi, Nand Kishor Kumar, Multidirectional Forging of High-Leaded Tin Bronze: Effect on Wear Performance, Metallography, Microstructure, and Analysis, Springer, December 2017, Volume 6, Issue 6, pp 577–590.
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9. AK Barnwal, DP Mondal, R Kumar, N Prasanth, R Dasgupta, Compressive Deformation Behavior of Open-Cell Cu-Zn-Al Alloy Foam Made Through P/M Route Using Mechanically Alloyed Powder, Journal of Materials Engineering and Performance 27 (3), 1450-1465, 2018.

10. DP Mondal, MD Goel, V Upadhyay, S Das, M Singh, AK Barnwal, Comparative Study on Microstructural Characteristics and Compression Deformation Behaviour of Alumina an Cenosphere Reinforced Aluminam Syntactic Foam, Transactions of the Indian Institute of Metals, 71(3), 567-577

11. S Birla, DP Mondal, S Das, N Prasanth, AK Jha, ANC Venkat, Compressive Deformantio Behavior of Highly Porous -AA2014-Cenosphere Closed Cell Hybrid Foam Prepared Using CaH_2 as Foaming Agent: Comparison with Al., Transactions of the Indian Institute of Metals 70 (7), 1827-1840, 2017.

12. DP Singh, RR Saxena, YK Sahu, K Narendra, K Rakesh, D Mondal, Statistical analysis of multi-environmental rice yield trial in Bastar district of chhattisgarh., Oryza 54 (2), 241-245, 2017.

13. SL Ahirwar, DP Mondal, M Pandey, RS Rajput, AB Agrawal, S Birla, Comparison of Effect of Heat treatment Schedules and shot peening Parameters on the Abrasive Wear Behavior of As Received and Quenched & Tempered Medium carbon steel.,2017.

14. A Aldoshan, DP Mondal, S Khanna, High strain rate behavior of cabon nanotubes reinforced aluminum foam, Journal of Engineering Materials and Technology 140 (1), 011011, 2017.

15. Shreshta Tiwari, shraddha Rajak, Dehi Pada Mondal, Debasis Biswas, Sodium hypochlorite is more effective than 70% ethanol against biofilms of clinical isolates of Staphylococcus aureus, /doi.org/ 10.1016/ j.ajic. 2017.12.015 (American Journal of Infection control.) (feb) 2018.

16. B N Yadav, Pradeep Singh, Rajeev Kumar, Ashutosh Pandey, D P Mondal ,LM13-SiC-CNT Hybrid Composite Foam Through Stir Casting Technique, Indian Foundry Journal , Vol 63, Issue 9, Sept 2017.

17. Rajeev Kumar, D.P. Mondal, Shyam Birla, Amit Vishwakarma, Anisha Chaudhary, Saroj Kumari , S. Das , Enhanced microwave absorption property of aluminum composites using fly ash derived cenosphere. Advanced Materials Letters, 2018,

18. Anisha Chaudhary, Rajeev Kumar, Satish Teotia, S.K. Dhawan, Sanjay R. Dhakate and Saroj Kumari, Integration of MCMB/MWCNTs with Fe_3O_4 in a flexible and light weight composite paper for promising EMI shielding applications. Journal of Materials Chemistry C,2017, 5, 322-332

19. Anisha Chaudhary, Satish Teotia, Rajeev Kumar, K. Ramesha, S.R Dhakate, Saroj Kumari. Novel Synthetic Strategy to Develop Mesocarbon Microbeads for Multi-functional Applications. Materials Research Express, 2018, 5, 4

20. V Srivastava, S Dubey, GK Gupta, IB Singh, Influence of Alpha Nano-alumina Reinforcement Content on the

Microstructure, Mechanical and Corrosion Properties of Al6061-Al_2O_3 Composite, Journal of Materials Engineering and Performance, 26 (9), 1-10.

21. M Paidpilli, GK Gupta, A Upadhyaya, Sintering Response of Aluminum 6061-TiB_2 Composite: Effect of Prealloyed and Premixed Matrix, Journal of Materials Engineering and Performance, 26(9), 4470–4480.
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25. R Kumar, S A R Hashmi, S Nimanpure, A Naik, Enhanced dynamic mechanical properties of kenaf epoxy composites, 2017, Advanced Materials Proceedings (VBRI Press), UK, 2 (11) 749-757, 2017.
26. S Nimanpure, S.A.R Hashmi, R. Kumar, A Nigrawal, H.N. Bhargaw and A. Naik, Sisal Fibril Epoxy Composite—A High Strength Electrical Insulating Material, 2017, Polymer Composites, UK, DOI: https://doi.org/10.1002/pc/24527.
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38. Sarika Verma, S.S. Amritphale and Satyabrata Das, Development of functionalized Nano precursor gel useful for making flexible and moldable radiation shielding material Journal of Materials Engineering and Performance, 1018, 2017.
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43. N. Sinha S. Goel, A J. Josepha, H. Yadav, K. Batra, Manoj Kumar Gupta Binay Kumar, Y-doped ZnO nanosheets: Gigantic piezoelectric response for an ultra-sensitive flexible piezoelectric nanogenerator, Ceramics International, 2018, 44, 8582 (IF ~ 3).

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45. Pooja Bhardwaj, Rainy Gupta, J. P. Shukla, Deepti Mishra, Manish Mudgal and Sudhir Sitaram Amritphale, The connection between female literacy and technology adoption in rural societies: Exploring female literacy and technology adoption for promoting the usage of water-based toilets in India, 2017, Technology in Society: An International Journal: Elsevier, IF 0.70 U.K., Vol. 50 Pp. 44-49.

46. Akinchan Singhai, Sandipan Das, Ajay kumar K. Kadam, J. P. Shukla, D. S. Bundela & Mahesh Kalashetty, GIS-based multi-criteria approach for identification of rainwater harvesting zones, 2017, Environment, Development, and Sustainability, Springer ISSN: 1387-585X (Print) 1573-2975 (Online), Germany, pp 1–21, https://doi.org/10.1007/s10668-017-0060-4.

47. Mohammad Subzar Malik , J. P. Shukla, Thermal Mapping Using Remote Sensing and GIS Techniques, 2017, International Journal of Earth science and Engineering (IJEE), India, Vol.10, No. 04.

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Information Technology Centre

This Information Technology group looks after the day-to-day operation of internet, intranet, web and email services in the institute with a view to smooth and effective operation of the system. The network utilizes a mixture of optical fibre, UTP cables and switches. The access to internet is provided through a gateway to the external world via a 10 Mbps leased line from BSNL. A local Area Network has been set up which connects together approximately 150 computers spread over the AMPRI campus. Migration to a more efficient infrastructure with new servers to improve the quality of service has already been done. Multi-layered firewall, anti-spam engine, antivirus solution has also been implemented to enhance the overall network security.

The group also helps the Institute to plan for improving the quality of the services in terms of increasing the capacity and speed of the internet system. This has been done keeping in mind the growing demand of the institute in view of its increasing activities and manpower, and establishing a less paper working system for more effective monitoring of the progress of various activities.

The major activities of the Information Technology (IT) Centre is to:

- Utilization of ICT tools for effective and efficient R&D Management along with other requirement of the institute.
- Showcasing the niche areas, expertise and knowledge of the institute through institutional website.
- Support to CSIR-AMPRI scientists IT savvy
- Utilize IT to realize economy of scales in common functions in transparent manner.
- Establishment and maintenance of digital document-based decision support system
- State –of- the -art data centre

CSIR-AMPRI Data Centre

Major Programmes

The major programme of the IT centre is: “Building a scientific knowledge grid, ICT infrastructure and services for CSIR-AMPRI.” The centre is providing support to high-end technology in developing scientific Management Grid solutions for enhancing the productivity of scientists through computing facilities to increase the pace of R&D activities.The group also rendering services to provide accurate, efficient, relevant information to the citizens in timely manner. To set up minimum benchmark for institute's website “Guidelines for Indian Government websites” formulated by National Informatics Centre adopted by the Department of Administrative reform and public grievances which are mandatory are being implemented to make the institute's website conform to the UUU trilogy i.e., user centric, user friendly and universally accessible. To implement these GIGW guidelines, the group is ensuring a consistent and tested framework for maintaining the uniformity to meet the citizen expectation at all times; authentic, accurate easily accessible website. The centre has also developed “Online Application submission” system application for calling online applications for recruitment of various positions/vacancies needed by the institute time to time.

Rajbhasha Activities

Hindi Diwas Ceremony

Hindi Diwas Ceremony

Hindi Week

The Hindi week started from September 8, 2017 concluded on September 14, 2017 as Hindi Divas Samaroh. Eminent writer and former ADG, Doordarshan Sh. Shashank . Palival was the Chief Guest at the main function. Various competitions, such as Chitra aur Vichar, Nibandh and Noting were organized for the staff during the week.

At the outset the then Acting Director Dr. S.S. Amritphale welcomed the guests and Dr. Manisha Dubey , Hindi Officer introduced the Chief Guest In his address the Chief Guest Sh. Shashank very interestingly described the status of hindi in the society. He said that the languages touch the feelings of masses. In recent years some languages are slowly being extinct. While giving interesting linguistic examples, he said that it is very easy to use easy language. He quoted senior thinker Sh. Ramvilas Sharma and said that the language is like a river which incorporates everything into it and such languages live longer. He also underlined the use of Hindi in administration.

The Chief Guest gave away the prizes for the winners of the competitions, prizes for best articles published in Sopan and incentives for working in Hindi. He also released the annual hindi magazine of the institute, SOPAN on the occasion.

Dr. Rupa Dasgupta, Chief Scientist proposed the Vote of thanks and the programme was conducted by Dr. Manisha Dubey, Hindi Officer.

Scientific Hindi Workshops

- A scientific Workshop was organized on June 30, 2017. The then Acting Director, Dr. S.S. Amritphale was the Chief Guest at the function and Dr. S. A. R. Hashmi , Sr. Principal Scientist chaired the Technical Session. At the outset Dr. J.P.Shukla, Sr. Principal Scientist underlined the objectives of this workshop.In his address Dr. Amritphale underlined the responsibilities of the scientists to disseminate the results of their work to the masses. Dr.S.K. Sanghi and Dr. V. Sorna Gowri presented papers in Hindi on "Lab on a chip'; Dr. S.K.S. Rathore and Dr. J.P. Chaurasia on "R&D Managemenr: Expectations and Present Status"; Dr. Edward Peters and Dr. P. Asokan on "The Scientific initiative for the sustainable Rural Development of Bharia tribe living in Patalkot valley of Tamia Block, Chhindwara, M.P."; Dr. Satanand Mishra, Dr. J.P.Shukla and Sabzar malik on "The constitution of Smart Water Grid for water supply".

Scientific Workshop

Dr. Manisha Dubey, Hindi Officer conducted the workshop and proposed the vote of thanks.

- A scientific workshop in Hindi was organised on March 27, 2018 . Director, CSIR – AMPRI, Dr. Avanish Kumar Srivastava was the Chief Guest at the function and Dr. SAR Hashmi, Sr. Principal Scientist chaired the Technical Session. At the outset Dr. Manisha Dubey, Hindi Officer underlined the objectives of the workshop. In his address Dr. Avanish Kumar Srivastava underlined the responsibilities of the scientists to disseminate the results of their work to the masses in Hindi. He said that it is more convenient to work in our own mother tongue.

Dr. Rupa Dasgupta presented paper on "CSIR – AMPRI ka aakaar smriti padarth ki or prayas ", Dr. Dipti Mishra presented paper on "Geopolymeric padarthon ka rasayan vigyan", Dr. Manoj Kumar Gupta presented a paper on "Bahuuddeshiy anuprayogon ke liye hydrophobic piezoelectric PVDF carbo nanotubes hybrid composite foam"and Dr Manish Mudgal, Eng. RK Chouhan, Prahlad Dubey, Abhishek Bisariya and Dr Avanish Kumar Srivastava presented a paper on "Aluminium utpadan udyog se janit lal mrida evam tap bijale sanyantr dvara janit udan rakh dvara nirmit geopolymer binder ka vikas" Dr. SAR Hashmi , in his address said that we receive more support from non hindi speaking persons. Implementation of Hindi mandatory in all part of official activities to highlight the National integration, he said.Dr. Manisha Dubey, Hindi Officer conducted the programme and proposed the vote of thanks.

AcSIR Related Activities at CSIR-AMPRI, Bhopal

AcSIR [Academy of Scientific and Innovative Research] at AMPRI, Bhopal since 2014 is offering Ph.D. programmes in Engineering Sciences (Materials Science and Technology) and Chemical Sciences to students selected following AcSIR norms. Students pursue research under Scientists of the laboratory in the areas in which CSIR-AMPRI, Bhopal is pursuing active and cutting edge research like lightweight and high strength materials, advanced forming techniques including electromagnetic forming, shape memory materials, nanostructured alloys and composites, natural resources and waste utilization, natural fibre based construction materials, radiation shielding materials, environmental and industrial chemistry and computer simulation and modeling. AcSIR at AMPRI Bhopal usually inducts fresh candidates twice a year in its January and August session. Keeping in mind the gamut of Scientists from different fields and the success of AcSIR-AMPRI, it has been proposed to start the Ph.D. programme in Physics also.

With immense sense of pride and satisfaction that CSIR-AMPRI records that two students have been conferred their Ph.D. degree in Chemistry in the month of January, 2018 and two more in the branch of Engineering Sciences have submitted their thesis. Seeds planted in 2014 are bearing fruits now and it is expected that more will be joining the stream at a regular pace.

AcSIR-AMPRI students have published around 20 SCI journal publications besides attending conferences in an effort to publish their research outcomes. On National Science Day, a session on poster presentations by AcSIR-AMPRI research fellows was organized at CSIR-AMPRI. A two tier committee of junior and senior level Scientists of the Institute judged the posters and presentations that followed and Ms. Swati Dubey and Mr. Pradeep Singh's were adjudged as the best and second best. They were felicitated by Director AMPRI during the Technology Day Celebrations at AMPRI and Ms. Swati Dubey presented her work in front of the gathering. Keeping the trend set since two years now, AcSIR-AMPRI students were awarded for maximum publications in the year and best performance in course work during CSIR Foundation Day celebrations at the Institute.

Students of AcSIR- celebrating Teachers Day at CSIR-AMPRI

Knowledge Resource Centre

The objective of the Knowledge Resource Centre (KRC) is to provide knowledge updates to the research personnel of the Institute through subscribing various technical journals, books, magazines and other means. AMPRI subscribes to the NKRC consortium for journal subscriptions in Chemistry and Material Science and also subscribes to a few more online journals decided on the basis of requests received from scientific community of the Institute. KRC has been an important means to make available the required technical information/ services from different publishers/agencies in order to keep our R&D personnel abreast with the current worldwide scientific developments in their areas. The technical resources currently available at CSIR-AMPRI are available online for the convenience of the researchers. CSIR-AMPRI KRC continues to use the proprietary software for library management system called “LIBSYS” for managing its resources. AMPRI-KRC is updated with migration to the newly developed integrated library management system as in the Open Public Access Catalogue (OPAC). The Institute also has developed its own Institutional repository.

The current year saw an addition of a number of books on different technical areas based on recommendations of CSIR-AMPRI staff to the library both in English and Hindi. The staff of KRC at AMPRI conduct cent percent of their official work in Hindi and has been felicitated for the same at the Institute.

Talks and Lectures Delivered

Invited Lectures

1. Hybrid Aluminium Composite foams for crashworthiness applications, July 2017, IITDM, Jabbalpur. Dr. D. P. Mondal
2. Al-foam : A multifunctional materials, September 2017, MANIT, Bhopal., Dr. D. P. Mondal
3. "In-situ Al –TiC composites" at JNARDDC Nagpur, 24th Feb 2018, Dr. Gaurav Gupta
4. Design, Analysis and Failure Assessment of Component using FEM and Fracture Mechanics, in TIT, Bhopal, 20th Feb, 2018, Dr. Sanjeev Saxena
5. Expertise of CSIR-AMPRI, Bhopal, Dr. Mohd. Akram Khan, 26th July 2017, NTPC Farakka, District Murshidabad (WB)
6. Geo-Polymeric Fly Ash : Wonder Material For The New Millennium Some Case Studies-Dr. Mohd. Akram Khan, 22nd August 2017, 'Seminar On Fly Ash Utilization' organized by Bharat Oman Refineries Limited, Bina (M.P.)
7. 'Know-How Transfer' on "Advanced Pavers Block From Copper Tailings" Dr. Mohd. Akram Khan, 30th November 2017 organised by Hindustan Copper Limited Malanjkhand, Balaghat (M.P)
8. Energy storage materials in Bio-Fuel cell,Dr. Surender Kumar,SATI Vidisha Workshop, 14th May 2018
9. Dr. J. P. Shukla, Principal Scientist, Application of Remote Sensing and GIS in Statistical Information's, Disaster Management Institute, Bhopal
10. Dr. S. K. Sanghi, Senior Principal Scientist and Dr. J. P. Shukla, Principal Scientist, Kendriya Vidyalaya No.1, Bhopal, 17/11/2017. Dr. Sanghi delivered lecture on the topic of "Lab on a Chip". Dr. Shukla highlighted the future scope, opportunities and careers in the field of science.
11. Dr. N. Sathish, Senior Scientist and Dr. Satanand Mishra, Scientist at Kendriya Vidyalaya No. 3 , 12/01/2018. Dr. N. Sathish explained about the 3D printing. Dr. Mishra highlighted the future scope, opportunities and carriers in the field of science and also about Jigyasa programme.
12. Dr. J. P. Shukla, Principal Scientist and Dr. Satanand Mishra, Scientist at Kendriya Vidyalaya No.2, Bhopal , 23/01/2018. Dr. Shukla gave a lecture on the topic of "Sustainable Water Resources Management ". Dr. Mishra has highlighted the future scope, opportunities and carriers in the field of science and also about Jigyasa.

Ph.D. Awarded/ Guided

1. Dr. Meraj Ahmed was awarded Ph.D. from the Department of Mechanical Engineering, Indian Institute of Technology, Delhi in Nov 2017 on the topic 'Effect of Process Variables on Formability of an Aluminum Alloy in Electrohydraulic Forming'
2. Dr. Pooja Bharadwaj, AcSIR, CSIR-AMPRI, Bhopal was awarded Ph.D. in Science [Chemical Sciences] in January 2018 on ' Development of advanced phosphatic geopolymeric multifunctional materials.
3. Dr. Rainy Gupta, AcSIR, CSIR-AMPRI, Bhopal was awarded Ph.D. in Science [Chemical Sciences] in January 2018 on 'Development of advanced hybrid inorganic-organic geopolymeric material for coating application.'
4. Dr. Sanjay Kumar Panthi guided a Ph.D. thesis on Studies on multidirectional forging of high leaded tin bronze alloy, Rahul Gupta, Material Science & Metallurgical Engineering Department, MANIT, Bhopal –Awarded in October 2017

Participation In Exhibitions

- Exhibition and meeting at Goa College of Engineering on 21st April, 2017
- Exhibition at Bundelkhand Srajan, Tikamgarh, M.P. on 05 June, 2017. Many attendees of the Srajan from rural areas as well as industry person visited our stall.
- Exhibition at National Convention for Startup, Bhopal 20 June, 2017. CSIR-AMPRI showcased its technology of Hybrid Green Composites.

Exhibition oat Academy of Administration, Bhopal

- Workshop at MANIT in collaboration with CDOS, Jaipur on 13 July, 2017. Presentation & showcasing of CSIR-AMPRI Hybrid Green Composites was done in the workshop.

Exhibition at Jaipur

- Industry Institute Enclave 2017 at Coimbatore on 9th August, 2017. CSIR-AMPRI hibited hybrid composite materials, prototype products for use in civil infrastructure. Other technologies highlights such as Cement free concrete, radiation shielding materials & alternative building materials.

- Industry Institute Integration 2018 was organized in Bengaluru on 19th January, 2018 in association with IPRITI, Bengaluru and IWST Bengaluru. Showcasing of hybrid composite of different design, colour, texture, thickness & dimensions was done.

Exhibition at Coimbatore

Staff News

Retirements on superannuation

- Indraj Yadav, Technician, 31.07.2017
- Dr. S.S. Amritphale, Acting Director, 31.10.2017
- Sh. Jaipal Kujur, Asstt. , 31.10.2017
- Mrs. Sathi Vijayan, PS, 30.11.2017

Voluntary Retirement

- Sh. S. Shrimanth, Principal Scientist, 30.08.2017

New Joining

- Dr. Avanish Kumar Srivastava joined as Director on 31.10.2017
- Sh. Nikhil R Gorhe joined as Scientist IV(2) on 12.04.2017
- Dr. Manoj Kumar Gupta joined as Scientist IV(2) on 16.05.2017
- Sh. Rahul Singh Chauhan joined as Asst. Gr. III (S&P) on 04.08.2017
- Dr. Shabi Thankaraj Salammal joined as Scientist IV(2) on 07.08.2017
- Sh. Praveen Kumar joined as Asst. Gr. III (F&A) on 10.08.2017
- Sh. Anand Vinod Deshmukh joined as Asst. Gr. III (G) on 11.08.2017
- Ms Seema Bisht joined as Junior Secretarial Assistant(G) on 26. 03.2018.

Assessment Promotions

- Dr. Ajay Naik, Sr. Technical Officer to Pr. Technical Officer
- Sh. R.K. Chauhan, Sr. Technical Officer to Pr. Technical Officer
- Sh. P. Banerjee, Sr. Technical Officer to Pr. Technical Officer
- Sh. Manik Chandra, Sr. Technical Officer to Pr. Technical Officer
- Ms. Swagatika Pal, Sr. Technician(1) to Sr. Technician(2)
- Ms. Prabha Padmakaran, Sr. Technical Officer(2) to Sr. Technical Officer(3)
- Sh. A. A. Bakhsh, EE to SE
- Sh. R.S. Ahirwar, Scientist IV(4) to Scientist IV(5)

Deputation Abroad

- Dr. J.P.Shukla, Principal Scientist visited China to attend the Environment Care Consortium Meeting jointly organized by Hebei University, China and University of Birmingham, UK during March 23 – 26, 2018.

Resignation

- Shri Anand Vinod Deshmukh resigned from the post of Junior Secretarial Assistant (G) on January 31, 2018.

Manpower As On 31st March, 2018

S.No.	Name	Designation
1	Dr. Avanish Kr. Srivastava	Director

Scientists

Group -IV (6)

1	Dr. Rupa Dasgupta	Chief Scientist
2	Dr. R.K. Morchhale	Chief Scientist

Group-IV (5)

1	Dr. S.A.R. Hashmi	Sr. Principal Scientist
2	Dr. S.K. Sanghi	Sr. Principal Scientist
3	Dr. D.P. Mondal	Sr. Principal Scientist
4	Dr. I.B. Singh	Sr. Principal Scientist
5	Dr. A.K. Singh	Sr. Principal Scientist
6	Dr. P. Asokan	Sr. Principal Scientist
7	Dr. R.K. Rawlley	Sr. Principal Scien tist
8	Dr. S.K.S. Rathore	Sr. Principal Scientist
9	Shri R.S. Ahirwar	Sr. Principal Scientist

Group-IV (4)

1	Dr. Mohd.Akram Khan	Principal Scientist
2	Dr. Manish Mudgal	Principal Scientist
3	Dr. J.P. Shukla	Principal Scientist
4	Dr. Sanje ev Saxena	Principal Scientist
5	Shri H.N. Bhargaw	Principal Scientist
6	Dr. Deepti Mishra	Principal Scientist
7	Dr. S. Murali	Principal Scientist

Group-IV (3)

1	Dr. J. P. Chaurasia	Sr. Scientist
2	Shri R.K. Bharilya	Sr. Scientist
3	Dr. Sathi sh N	Sr. Scientist

Group-IV (2)

1	Dr. Sanjay K. Panthi	Scientist
2	Dr. Meraj Ahmed	Scientist
3	Dr. Gaurav Kumar Gupta	Scientist
4	Dr. Alka Mishra	Scientist
5	Dr. Satanand Mishra	Scientist
6	Dr. Abhishek Pandey	Scientist
7	Shri Venkat A N Ch	Scientist
8	Shri Sriram Sathaiah	Scientist
9	Dr. Tilak Chandra Joshi	Scientist
10	Shri Mohammad Ashiq	Scientist
11	Dr. Surendra Kumar	Scientist
12	Shri Mohit Sharma	Scientist
13	Shri Nikhil Rajendra Gorhe	Scientist
14	Dr. Manoj Kumar Gupta	Scientist
15	Dr. Shabi T hankaraj Salammal	Scientist

Technical Staff-III

1	Dr. Narayan Saha	Prin. TO/Tech. Gr.III(7)
2	Dr. R.K. Chauhan	Prin. TO/Tech. Gr.III(7)
3	Dr. Ajay Naik	Prin. TO/Tech. Gr.III(7)
4	Shri P.Banerjee	Prin. TO/Tech. Gr.III(7)
5	Shri Ma nik Chandra	Prin. TO/Tech. Gr.III(7)
6	Dr. J.P. Pandey	Sr. TO(3)/Tech. Gr.III(6)
7	Dr. Edward Peters	Sr. TO(3)/Tech. Gr.III(6)
8	Dr. R.K. Soni	Sr. TO(3)/Tech. Gr.III(6)
9	Dr.V. Sorna Gowri	Sr. TO(3)/Tech. Gr.III(6)
10	Shri T.S.V.C. Rao	Sr. TO(3) /Tech. Gr.III(6)
11	Shri Manoj Kumar Ban	Sr. TO(3)/Tech. Gr.III(6)
12	Shri Ajay Kulshreshth	Sr. TO(3)/Tech. Gr.III(6)
13	Dr.Prabha Padmakaran	Sr. TO(3)/Tech. Gr.III(6)

14	Shri Anwar Ahmed Bakhsh	Supdt. Engineer/Tech. Gr.III(6)
15	Mrs. Sangeeta Gamad	TO/Tech. Gr.III(4)
16	Shri O.P. Chaurasia	JE/Tech. Gr.III(3)
17	Shri Deepak K. Kashyap	Tech. Gr.III(1)
18	Shri Balwant Barkhaniya	Tech. Gr.III(1)
19	Shri Muhamed Shafeeq M.	Tech. Gr.III(1)
20	Shri Anup Kumar Khare	Tech. Gr.III(1)
21	Shri Khelendra K Naktode	Tech. Gr.III(1)
22	Shri N. Prashanth	Tech. Gr.III(1)

Technical Staff -II

1	Shri R.K. Gurjar	Tech. Gr.II(4)
2	Shri Abhay Yadav	Tech. Gr.II(4)
3	Shri Mohd. Rafique	Tech. Gr.II(4)
4	Shri Madan Lal Gurjar	Tech. Gr.II(4)
5	Shri Akhtar Ullah	Tech. Gr.II(4)
6	Shri Arun Saxena	Tech. Gr.II(4)
7	Shri A.K. Asati	Tech. Gr.II(4)
8	Shri S.K. Suryavanshi	Tech. Gr.II(4)
9	Mrs. Swagatika Pal	Tech. Gr.II(4)

Technical Staff - I

1	Shri L.N. Sahu	Tech. Gr I(4)
2	Shri S.K. Batham	Tech. Gr I(4)
3	Shri S.K. Raikwar	Tech. Gr I(4)
4	Shri L.N. Mehra	Tech. Gr I(4)
5	Shri N.S. Jadav	Tech. Gr I(4)
6	Shri Anil Gond	Tech. Gr I(4)

Administration

1	Shri Y. Ramakrishna	Sr. Controller of Admin.
2	Shri R.N. Waghmare	Administrative Off icer
3	Shri A.K. Jain	Section Officer (G)
4	Shri P.K. Srivastava	Protocol Officer
5	Dr. Manisha Dubey	Hindi Officer
6	Smt. Shyamala Soman	Private Secretary
7	Smt. Mini Surendran	Private Secretary
8	Shri N. Viswanathan	Private Secretary
9	Smt. Asha Vinodia	Asstt. Section Officer (Gen)
10	Shri Neelesh Jaiswal	Asstt. Section Officer (Gen)
11	Shri Harihar Singh Yadav	Asstt. Section Officer (Gen)
12	Smt. Antia Daniel	Receptionist
13	Shri G. Adinarayana	Security Officer
14	Shri Sourabh Sethiya	Jr. Steno.
15	Ms. Seema Bisht	Jr. Secretariat Asstt.(Gen)
16	Mrs. Trishala Rangari	Record Keeper
17	Shri K.P. Tripathi	Jr. Security Guard
18	Shri R.N. Pradhan	Jr. Security Guard
19	Shri Devtanand Prasad	Tea & Coffee Maker
20	Shri Dayaram	Safaiwala
21	Mrs. Asha Golait	Peon

Finance & Accounts

1	Shri Dheeraj	Finance & Accounts Officer
2	Shri Sanjay Vinodia	Section Officer (F&A)
3	Shri Vijay Shrivastava	Asstt. Section Officer (F&A)
4	Shri Praveen Kumar	Jr. Secretariat Asstt.(F&A)

Stores & Purchase

1	Shri P.M. Verma	Stores & Purchase Officer
2	Shri R.D. Chinchulkar	Section Officer (S&P)
3	Shri D.M. Chilbule	ASO (S&P) under suspension
4	Shri Vijay Nathiley	Asstt. Section Officer (S&P)
5	Shri S.S. Tomar	Asstt. Section Officer (S&P)
6	Shri Ra hul S. Chouhan	Jr. Secretariat Asstt.(S&P)

प्रशासन

1.	श्री वाई रामकृष्णा	वरि. प्रशासन नियंत्रक
2.	श्री पी.एम. वर्मा	भण्डार एवं क्रय अधिकारी
3.	श्री आर.एन. वाघमारे	प्रशासनिक अधिकारी
4.	श्री अतुल कुमार जैन	अनुभाग अधिकारी (सा.)
5.	श्रीमती श्यामला सोमन	निजी सचिव
6.	श्रीमती मिनी सुरेन्द्रन	निजी सचिव
7.	श्री पवन कुमार श्रीवास्तव	प्रोटोकॉल अधिकारी
8.	डॉ मनीषा दुबे	हिन्दी अधिकारी
9.	श्री एन. विश्वनाथन	निजी सचिव
10.	श्रीमती आशा विनोदिया	सहा.अनुभाग अधिकारी (सा.)
11.	श्री नीलेश जयसवाल	सहा.अनुभाग अधिकारी (सा.)
12.	श्री हरिहर सिंह यादव	सहा.अनुभाग अधिकारी (सा.)
13.	श्री गुण्डु आदिनारायण	सुरक्षा अधिकारी
14.	श्री सौरभ सेठिया	कनि. आशुलिपिक
15.	सुश्री सीमा बिष्ट	कनि.सचिवालयीन सहायक (सा.)
16.	श्रीमती अनिता डेनियल	स्वागती
17.	श्रीमती त्रिशला रंगारी	रिकॉर्ड कीपर
18.	श्री आर.एन. प्रधान	कनिष्ठ सुरक्षा गार्ड
19.	श्री देवतानंद प्रसाद	टी एण्ड कॉफी मेकर
20.	श्री दयाराम	सफाईवाला
21.	श्रीमती आशा गोलाईट	चपरासी

वित्त एवं लेखा

1.	श्री धीरज	वित्त एवं लेखा अधिकारी
2.	श्री संजय विनोदिया	अनुभाग अधिकारी (वि. एवं ले.)
3.	श्री विजय श्रीवास्तव	सहा. अनुभाग अधिकारी (वि. एवं. ले.)
4.	श्री प्रवीण कुमार	कनि.सचिवालयीन सहायक (वि.एवं ले.)

भंडार एवं क्रय

1.	श्री पी.एम. वर्मा	भण्डार एवं क्रय अधिकारी
2.	श्री आर डी चिंचुलकर	अनुभाग अधिकारी (भण्डार एवं क्रय)
3.	श्री डी.एम. चिलबुले	ए.एस.ओ. (भण्डार एवं क्रय)
4.	श्री विजय नथीले	ए.एस.ओ. (भण्डार एवं क्रय)
5.	श्री शैलेन्द्र सिंह तोमर	ए.एस.ओ. (भण्डार एवं क्रय)
6.	श्री राहुल सिंह चौहान	कनि.सचिवालयीन सहायक (भण्डार एवं क्रय)

14.	श्री अनवर अहमद बख्श	सु. इंजीनियर
15.	श्रीमती संगीता गामड़	तकनीकी अधिकारी
16.	श्री ओमप्रकाश चौरसिया	तक. ग्रुप III(1)
17.	श्री दीपक कुमार कश्यप	तक. ग्रुप III(1)
18.	श्री बलवंत बरखानिया	तक. ग्रुप III(1)
19.	श्री मोहम्मद शफीक एम	तक. ग्रुप III(1)
20.	श्री अनूप कुमार खरे	तक. ग्रुप III(1)
21.	श्री खेलेन्द्र कुमर नाकतोडे	तक. ग्रुप III(1)
22.	श्री एन. प्रशान्त	तक. ग्रुप III(1)

तकनीकी स्टाफ – II

1.	श्री आर. के. गुर्जर	तक. ग्रुप II (4)
2.	श्री अभय यादव	तक. ग्रुप II (4)
3.	श्री मोहम्मद रफीक	तक. ग्रुप II (4)
4.	श्री मदन लाल गुर्जर	तक. ग्रुप II (4)
5.	श्री अख्तर उल्लाह	तक. ग्रुप II (4)
6.	श्री अरूण सक्सेना	तक. ग्रुप II (4)
7.	श्री ए.के. असाटी	तक. ग्रुप II (3)
8.	श्री एस.के. सूर्यवंशी	तक. ग्रुप II (3)
9.	श्रीमती एस. पाल	तक. ग्रुप II (3)

तकनीकी स्टाफ– I

1.	श्री एल.एन. साहू	तक. ग्रुप II (4)
2.	श्री एस.के. बाथम	तक. ग्रुप II (4)
3.	श्री एस.के. रायकवार	तक. ग्रुप II (4)
4.	श्री एल.एन. मेहरा	तक. ग्रुप II (3)
5.	श्री एन.एस. जादव	तक. ग्रुप II (3)
6.	श्री अनिल गोंड	तक. ग्रुप II (3)