एम्प्री

प्रगत पदार्थ तथा प्रक्रम अनुसंधान संस्थान

(पूर्व में क्षेत्रीय अनुसंधान प्रयोगशाला, भोपाल)

आई.एस.ओ. 9001 : 2000 प्रमाणित संस्थान

AMPRI

Advanced Materials and Processes Research Institute

(Formerly Regional Research Laboratory, Bhopal)

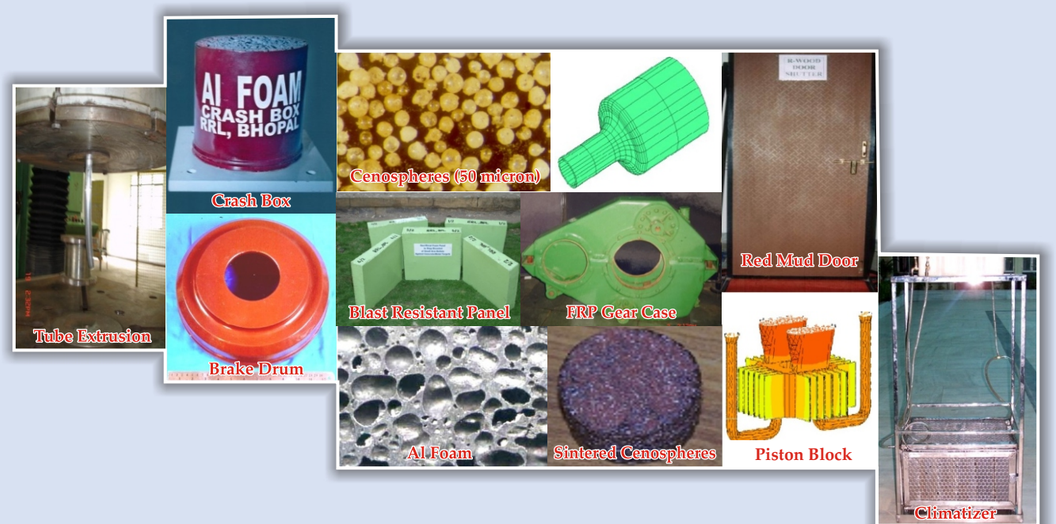
An ISO 9001:2000 Organisation

प्रगति प्रतिवेदन 2005-2007

Progress Report 2005-2007

Light Weight Metallic Materials

Over the years, the institute has established itself in the areas of Aluminium and Magnesium alloys development and in particular Metal Matrix Composites; also making progress in extrusion, electro magnetic forming and special processing techniques for light alloy products. Exploitation of industrial wastes for making cost effective products is one of the features of the institute. Red-mud based panel products and cenospheres from flyash are some examples. These materials and products find applications in aerospace, automobile, green infrastructure, defense, construction sector etc.



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डॉ. एन. रामकृष्णन
निदेशक

वर्ष 2005-2007 की अवधि का प्रगति प्रतिवेदन प्रस्तुत करना मेरे लिए अत्यंत हर्ष का विषय है। इस अवधि में प्रयोगशाला के नाम परिवर्तन के अतिरिक्त अनेक महत्वपूर्ण अवसर आये हैं। वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद् के प्रबंध निकाय ने अपनी सभी क्षेत्रीय अनुसंधान प्रयोगशालाओं को उनकी रूपरेखा को दर्शाने के उद्देश्य से नया नाम दिया है। क्षेत्रीय अनुसंधान प्रयोगशाला, भोपाल को पदार्थ एवं प्रक्रमों के क्षेत्र में अपनी क्षमताओं के आधार पर प्रगत पदार्थ एवं प्रक्रम अनुसंधान संस्थान (एम्प्री) का नया नाम दिया गया है। यह सर्वज्ञात है कि संस्थान मुख्यतः हल्के पदार्थों; भवन निर्माण सामग्री; प्राकृतिक रेशों; औद्योगिक अपशिष्टों से निर्मित सामग्रियों आदि के क्षेत्र में कार्यरत है। इन क्षेत्रों का चयन मोटरकार, ग्रामीण, पर्यावरण हितैषी औद्योगिक प्रक्रमों इत्यादि प्रक्षेत्रों को दृष्टिगत रखकर किया गया है। मध्यप्रदेश में सी.एस.आई.आर. की एकमात्र प्रयोगशाला होने के कारण संस्थान सी.एस.आई.आर. के अन्य तथा बाहरी महत्वपूर्ण संस्थानों से संपर्क का कार्य करते हुए क्षेत्र के विकास की दिशा में कार्य करेगा।

हमारा उद्देश्य उक्त प्रक्रमों में विश्वस्तरीय क्षमता प्राप्त करना तथा पदार्थो एवं प्रक्रमों के क्षेत्र में उत्कृष्टता हासिल करते हुए अपना एक स्थान बनाना है। हम अधिक परिष्कृत क्षेत्रों, जैसे नैनो पदार्थो का विकास, नैनो प्रौद्योगिकी, नेम्स एवं मेम्स,

पदार्थ प्रतिरूपण एवं अभिकल्पन, जैव–अनुकारी पदार्थ एवं समय के साथ–साथ और भी क्षेत्रों में कार्य कर रहे हैं किन्तु वर्तमान में ये कार्य अभी प्रारंभिक अवस्था में ही हैं। नए मानव संसाधन प्रोफाइल से पदार्थों के क्षेत्र में बुनियादी अनुसंधान से लेकर व्यापार विकास तक की आवश्यकताएं पूरी होंगी एवं हमारे उपस्कर संसाधनों में भविष्य के पदार्थों के विकास की आवश्यकताओं को पूर्ण करने के लिए पर्याप्त वृद्धि होगी। हमारे द्वारा निर्मित किया जा रहा वर्तमान संसाधन आधार न केवल वर्तमान के लिए वाणिज्यिक वश्यता प्रदान करेगा बल्कि भविष्य में अधिक आकर्षक एवं नवोन्मेषी क्षेत्रों के लिए आधार भी प्रदान करेगा। हम आशा करते है कि यह संस्थान उच्च स्तरीय पदार्थ वैज्ञानिकों एवं उद्योगों के लिए एक तीर्थस्थल के समान महत्व रखेगा। हमारी दृष्टि क्षितिज पर है और हमारे कदम मजबूती से निरंतर अग्रसर हैं।

पदार्थ एवं संसाधन प्रतिरूपण के क्षेत्र में एक महत्वपूर्ण स्थान बनाने की इच्छा किसी भी दशा में संस्थान की ग्रामीण प्रद्योगिकी विकास के क्षेत्र में चल रही गतिविधियों में बाधक नहीं होती। संस्थान में अभी हाल में समग्र सी.एस.आई.आर. ग्रामीण प्रौद्योगिकियों की उपलब्धियों के प्रदर्शन के उद्देश्य से एक उत्कृष्ट ग्रामीण प्रौद्योगिकी दीर्घा की स्थापना की गयी है। यह दीर्घा अन्य प्रयोगशालाओं में इसी प्रकार की दीर्घाओं की स्थापना के लिए प्रादर्श का कार्य करेगी।

संस्थान को फ्लाय एश उपयोग के क्षेत्र में उत्कृष्ट कार्य के लिए राष्ट्रीय पुरस्कार प्रदान किया गया। यह पुरस्कार भवन घटकों, कृषि एवं मूल्य योजित पदार्थों के लिए फ्लाय एश के उपयोग से संबंधित अनुसंधान एवं विकास के लिए दिया जाता है और इसे संयुक्त रूप से पर्यावरण तथा वन मंत्रालय एवं विज्ञान तथा प्रौद्योगिकी विभाग द्वारा दिया गया। इस पुरस्कार से न केवल प्रसन्नता का आगमन हुआ बल्कि इससे हम इस क्षेत्र में अपने कार्य को और अधिक ऊंचाई तक पहुँचाने के लिए उत्तरदायी भी हुए हैं।

भविष्य बहुत ही उज्ज्वल है क्योंकि संस्थान मोटरकारों के लिए हल्के पदार्थों एवं ग्रामीण रोजगार बढ़ाने के लिए सिसल रेशा प्रौद्योगिकियों पर महत्वपूर्ण अनुसंधान एवं विकास योजनाओं में कार्यरत है। इन कार्यक्रमों के परिणामस्वरूप निश्चय ही मोटरकारों जैसे उच्च अभियाँत्रिकी प्रक्षेत्रों की आवश्यकताएं पूरी होंगी तथा ग्रामीण समुदायों को सतत आजीविका देने में सहायता मिलेगी।

Foreword

Dr. N. Ramakrishnan
Director

It is a great privilege for me to present the progress report of the institute for the period 2005-2007. Many important events and the name change of the laboratory have taken place during this time. The Governing Body of the Council of Scientific and Industrial Research (CSIR) has renamed all its five Regional Research Laboratories (RRLs) to enable them to reflect true profile. Regional Research Laboratory, Bhopal has been renamed as Advanced Materials and Processes Research Institute (AMPRI) based on its core strength in the area of Materials and Processes. It is well known that the laboratory is mainly engaged in the areas of light weight materials, building materials, natural fibers, materials from industrial waste etc. These areas have been chosen in order to serve the Automobile, Rural and Environment sectors etc. Being the only CSIR laboratory in Madhya Pradesh the institute will continue to serve the region as a gateway for the other CSIR and major research institutions of the country.

The target is to achieve a world-class status in the major areas listed above and establish a niche in the areas of Materials and Processes. We are pursuing more sophisticated areas such

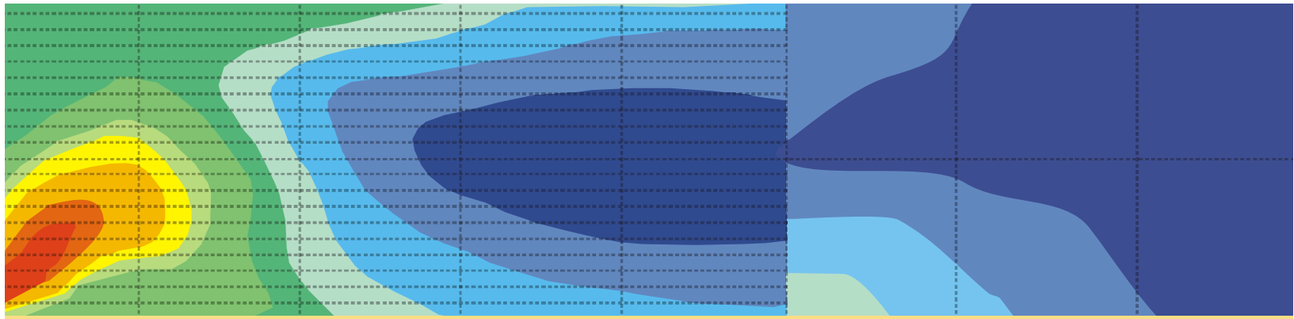
as Nano material development, Nano Technology, NEMS & MEMS, Material modeling and design, Bio-Mimetic material and so on but presently these are in initial stages. The evolving HR Profile would address fundamental research to business development. Our equipment resources will grow substantially to address the development of the materials of future. The present resource base that we are building will not only provide commercial tractability for the present but also provide a root for more lucrative and innovative areas of future. We hope to make the institute a place of pilgrimage for top class material scientists and industries. With our eyes set on the horizon, legs would march on the ground firmly and steadily.

The desire for establishing a niche in the area of materials and resource modeling, in no way places any hindrance for the institute to pursue Rural Technology development. The institute has recently completed the construction of a State-of-Art Rural Technology Gallery to showcase the output of the entire CSIR rural technologies and is intended to be a model for easy adaptation for the other laboratories to create such Rural Galleries.

The institute has been awarded the National Award in recognition of exemplary work done in the area of Fly Ash Utilization. The award was given for the research and development work related to use of fly ash for building components, agriculture & value added products and was jointly conferred by the Ministry of Environment and Forests and Deptt. Of Science and Technology, GOI. The award has not only brought celebrations but also makes us responsible to take the outputs to further heights in this area.

The future is promising as the institute is executing major R&D programs in light weight materials development for automobiles and Sisal Fiber Technologies for rural employment generation. The outcome of the programs will certainly address high end engineering sectors like automobiles as well as creating sustainable livelihood for rural communities.

Foreword



एम्प्री-एक दृष्टि में

AMPRI AT A GLANCE

Quality Policy

Advanced Materials and Processes Research institute (AMPRI), Bhopal adopts a quality policy to achieve excellence and customer focus in R & D projects and services related to design and development in the areas of Materials, Minerals, Environment and Rural Technology. The Institute shall continually improve the quality management system to derive customer satisfaction.

Vision

AMPRI, Bhopal shall endeavor to attain excellence and world-class stature in design and development of materials and processes related to engineering materials, alternate building materials, minerals and environment management. The laboratory shall aim to be a vital source of S&T for societal missions in water and rural technologies. Towards this AMPRI, Bhopal shall constantly generate high quality science based knowledgebase and facilitate its utilization. The laboratory aspires to provide competitive R&D and technical services in the above-mentioned areas.

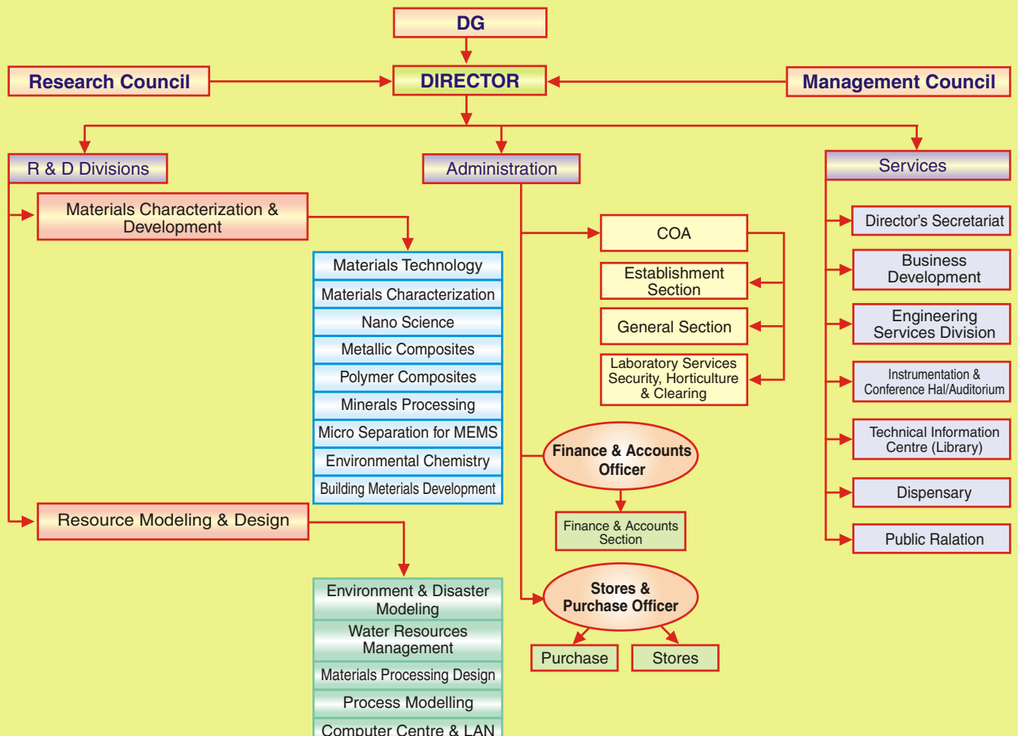
In the coming years, AMPRI, Bhopal shall carry out applied and basic research projects and transfer/disseminate know-how and technology to customer/stakeholder in mission mode in the following areas:

Sisal Fibre Technologies: Developing sisal fibre technologies such as, processing, weaving, making composite materials and dissemination of knowhow to rural communities.
Waste Utilization: Developing or extracting useful materials from industrial wastes such as flyash, red mud etc.
Metal Matrix Composites: Developing melt route MMCs for automobile, aerospace, tribological applications and accident resistant materials.
Design Capabilities: Developing expertise to render services in the areas of material characterization, process/equipment design and CAE-CAD-CAM integration.
Resources Modeling: Developing expertise to render services in environment, disaster, water resources modeling and management.

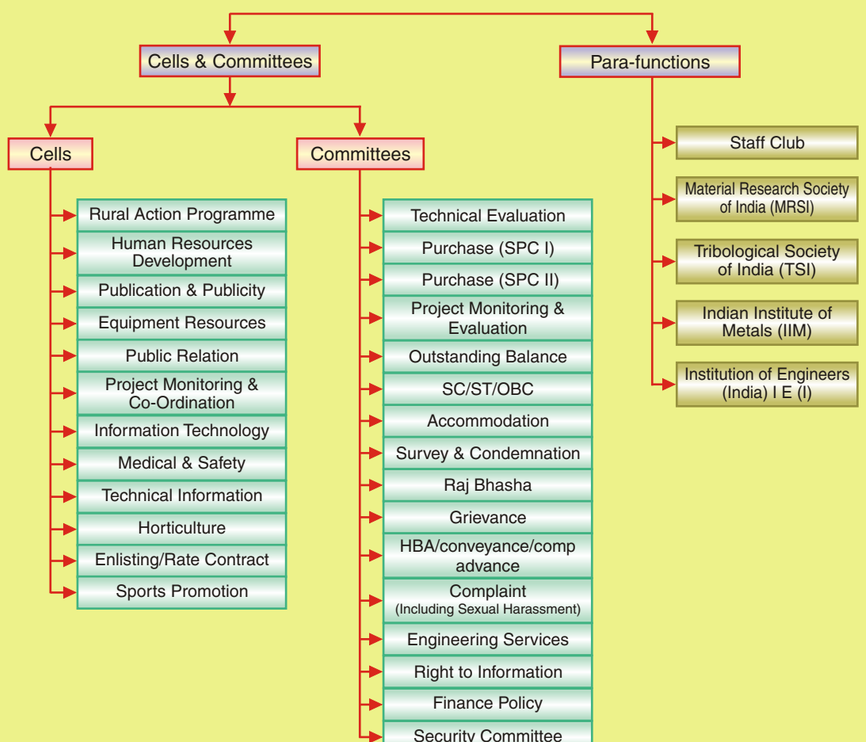
Mission

To model, design, innovate or improve materials as well as processes directed towards industrial, societal and environmental implementation for a sustained realization through scientific research.

Organisation Chart

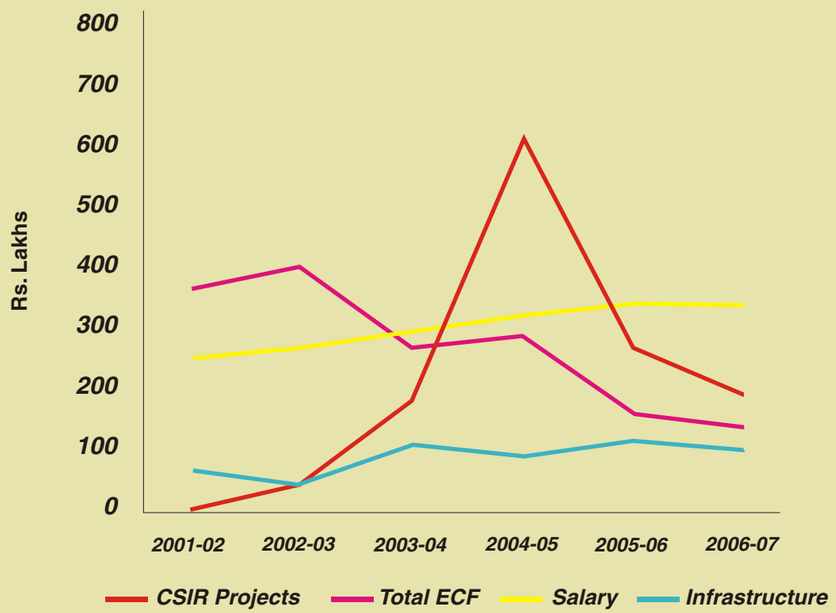


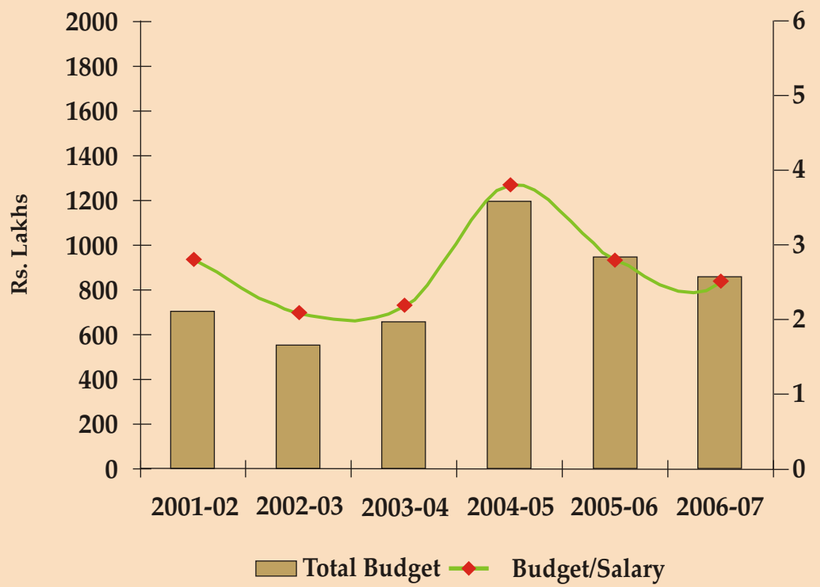
Cells and Committees



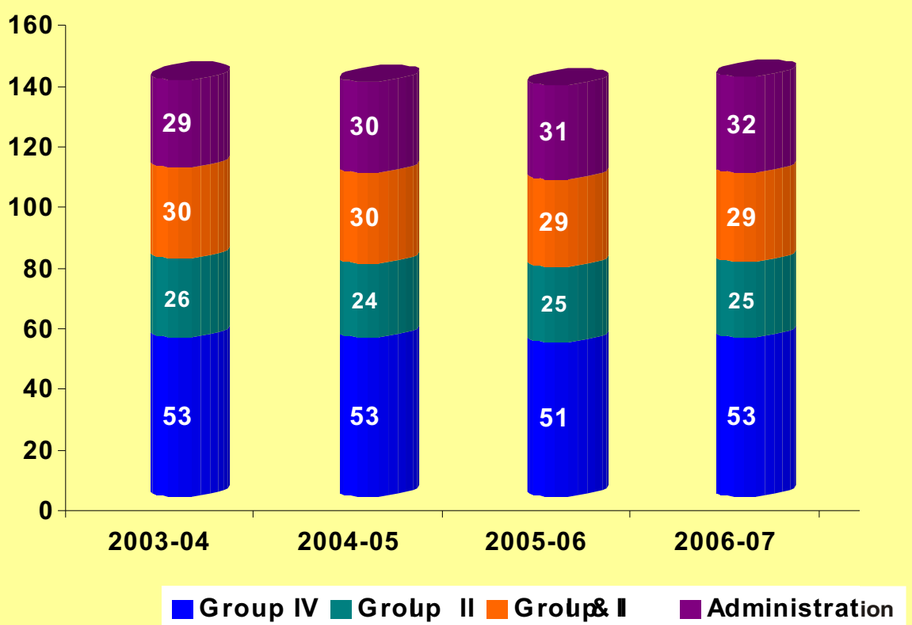
Planned Resources

Total Budget

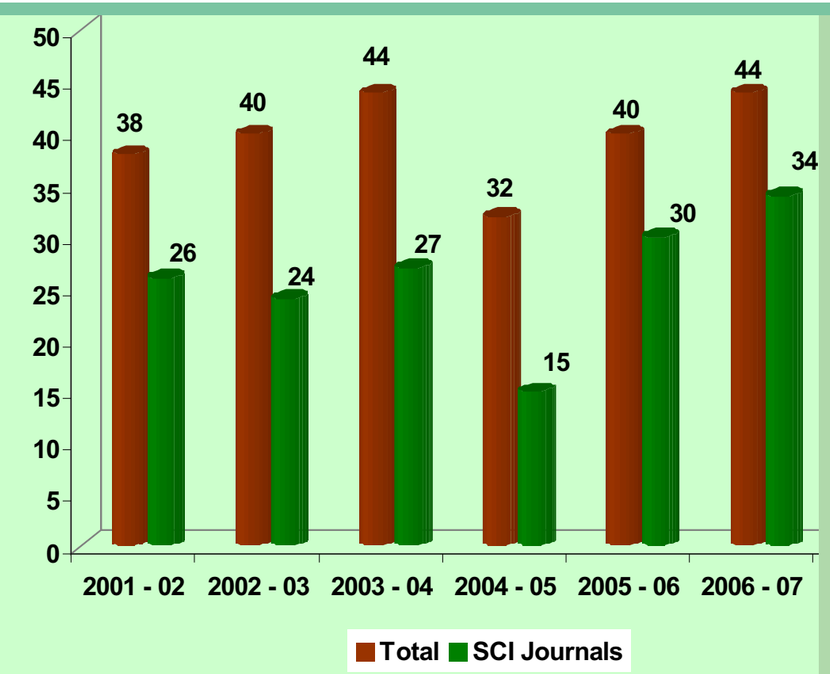




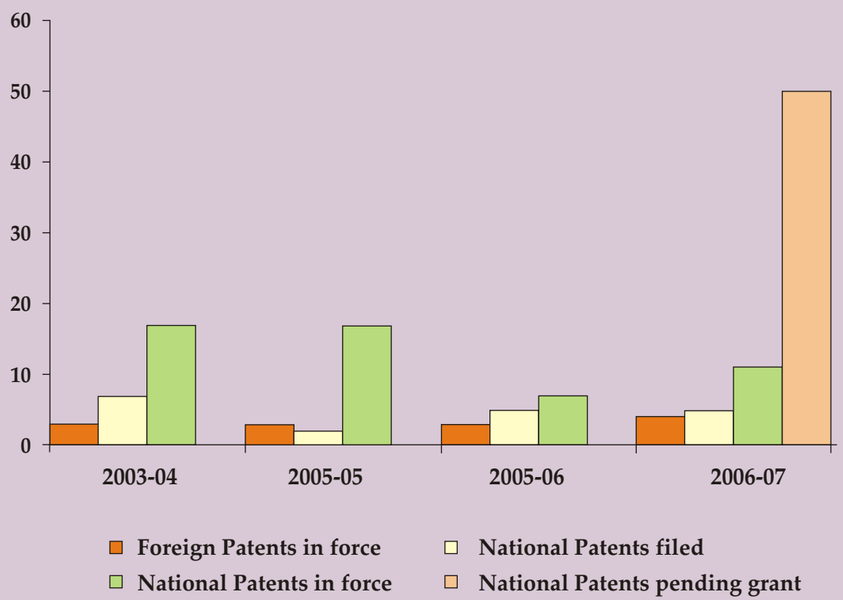
Human Resources



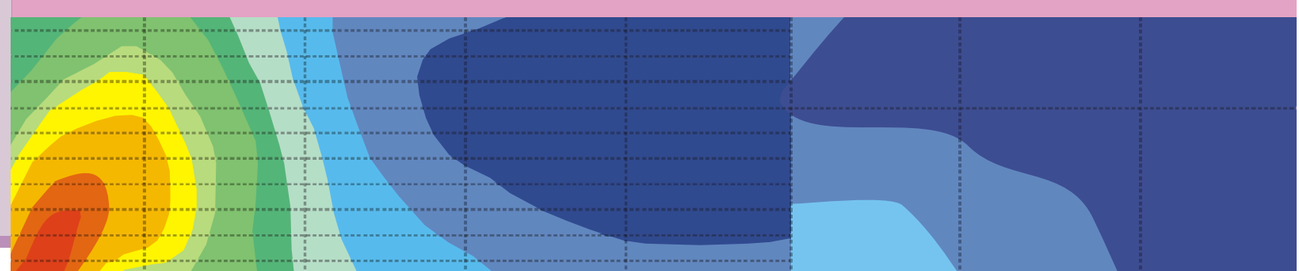
Publications



Patent Profile



प्रमुख अनुसंधान एवं विकास गतिविधियाँ
R & D Highlights



DEVELOPMENT OF ALUMINIUM FOAM For ENGINEERING APPLICATIONS

Description:

Enormous efforts are being made for light weight multifunctional materials for (i) energy and material saving, (ii) performance improvement, (iii) greater safety, (iv) noise, shock and vibration control, in the present era. Continuous efforts of the researcher throughout the world lead to the development of new class of ultra light materials suitable for energy absorption and sound & vibration control. Aluminium metallic foam is a class of such multifunctional material. The density of these materials comes as low as 0.13gm/cc which is twenty times less than that of aluminium. Advanced Materials and Processes Research Institute (AMPRI), Bhopal has initiated research work on "**The development of aluminium foams for engineering applications**". Through continuous effort, AMPRI has been able to develop the process in laboratory scale for synthesizing aluminium foam using a liquid metallurgy process wherein the liquid metal is foamed using a foaming agent and then cooled subsequently the foamed metal. The process has been developed in batch scale and needs to be upscaled for larger production.

The Process

The Process :

The process involves melting of aluminium alloy which is then cleaned and degassed using standard aluminium melting technology. The aluminium alloy melt is then thickened either with addition of ceramic particles such as SiC, Al_2O_3 etc. or granular calcium metal through mechanical stirring. Precautions were taken for uniform distribution of particles. After addition of thickening agent, a suitable temperature (between 660 to 680°C) is maintained and foaming agent such as metal hydride and metal carbonate in the form of powders are added into the composite melt through mechanical stirring. Special techniques were used while adding foaming agent into the melt so that wastage of foaming agents interns of burning and blowing off, is minimized and the foaming agent is mixed uniformly. The mixing of foaming agent into the melt is carried out in a crucible made with good thermal conductive materials. After mixing the foaming agent the melt is allowed to foam for one or two minutes and then allowed to cool rapidly to avoid drainage of developed foam in the liquid stage. The process parameters like amount of thickening agent, foaming agent, temperature of foaming, stirring speed for mixing, stirring time, holding time for foaming, cooling rate etc, have been optimized in order to optimize density, pore size and its distribution of aluminum foam. A series of aluminum alloys including Al-Si alloys, Al-Cu alloys and Al-Zn-Mg alloys have been used successfully for making Aluminum foam.

Range of Properties of Aluminium Foam Made at AMPRI, Bhopal

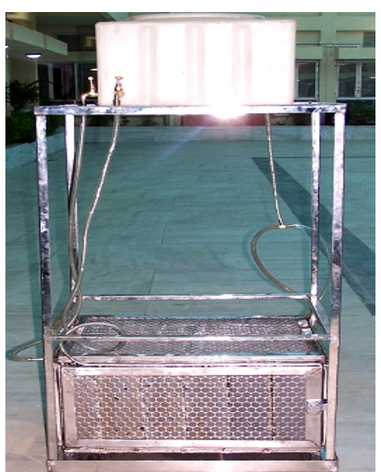
Range of Properties of Aluminium Foam Made at AMPRI, Bhopal

Sl. No.	Particulars	Values
1.	Density (gm/cc)	0.15 to 0.90
2.	Relative density	0.06 to 0.32
3.	Elastic Modulus (GPa)	0.28 to 5.00
4.	Plateau stress (MPa)	0.5 to 12.00
5.	Densification Strain	0.4 to 0.65
6.	Energy Absorption (MJ/m^3)	0.5 to 4 .0
7.	Damping capacity	0.05-0.1 (50-100 times more than dense aluminium
8.	Cell size (mm)	0.1 to 4.0
9.	Cell Wall Thickness (m)	80 to 400

RURAL CLIMATIZER

Prototype Components

1. Rural Climatizer
2. Crash Box
3. Blast resistance panel



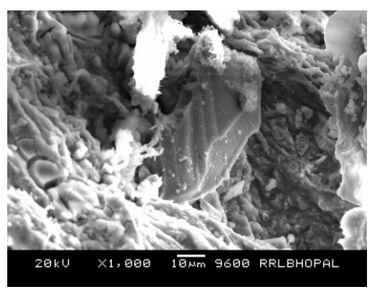
Climatizer

Rural Climatizer

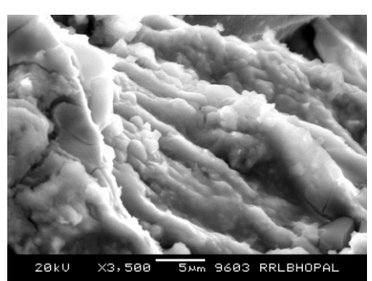
Open cell Aluminum foam emerged as potential material for thermal management applications. Aluminium foam has porosity in the range of 60-90% and the pore size varies in the range of 1-2 mm. The density of Al foam varies in the range of 0.2-0.6 g/cc. Because of its large surface area, open cell Al foam can be used in the application of heat sink, heat exchanger and as evaporator.

Synthesis: Usually open cell Al foam is produced by infiltration of polyurethane foam with heat resistant material. The polyurethane foam is removed by heating and liquid metal is infiltrated through the fine pore. AMPRI, Bhopal has developed a novel technique to produce open cell Al foam using melt route. The process essentially consists of thickening the melt by externally adding ceramic particulates followed by dispersing suitable foaming agent.

A climatizer is designed and fabricated using open cell Al foam. It is designed in such a way that the efficient cooling of the chamber is attained without using electricity so that it can be used in rural sector most effectively. It works on the principle that the heat is taken away as the latent heat of evaporation by water through the open cell Al foam from the chamber.



Microstructure of open cell



Microstructure of open cell
Al foam showing fibrous channels

CALCULATION OF FREE SURFACE AREA OF FOAM:

Let the relative density of foam: R

Volume fraction of pore: (1-R)

Volume of foam: V

Volume of pore (V_f): V (1-R)

Volume of single pore: $3.14*d^3/6$

(d: Diameter of a pore)

Number of Pore (N): $(V (1-R)*6)/ (3.14*d^3)$

Surface area of single pore: $3.14*d^2$

Total surface area of pore:

6V (1-R)/d

CALCULATION FOR COOLING EFFECT:-

Calculation for Cooling Effect:

$W = (25+19v) A (Xs - X)/3600$ (ref.: www.engineeringtoolbox.com)

Where, W: Volume of water evaporated

A: surface area (m^2)

v: air circulation velocity (m/sec)

X_s: humidity ratio in saturated air at the same temperature as the water surface (Kg/kg)

X: humidity ratio in air (Kg/kg)

Heat supplied for evaporation (Q_1): $h_w.W$

h_w: heat of water evaporation (2500 KJ/kg)

The same is extracted from the surroundings and the water present within the foam panels

Heat loss from water and foam material (Q_2): $(m_a s_a + m_w s_w) \Delta T$

Where m: mass, s: specific heat, subscripts a and w are for Al and water respectively.

Equating $Q_1 = Q_2$

$\Delta T = 6f[(25+19v) (V(1-R) (X_s\ X)/(3600*d*((V*R*s_a + 4.2*m_w)))]$

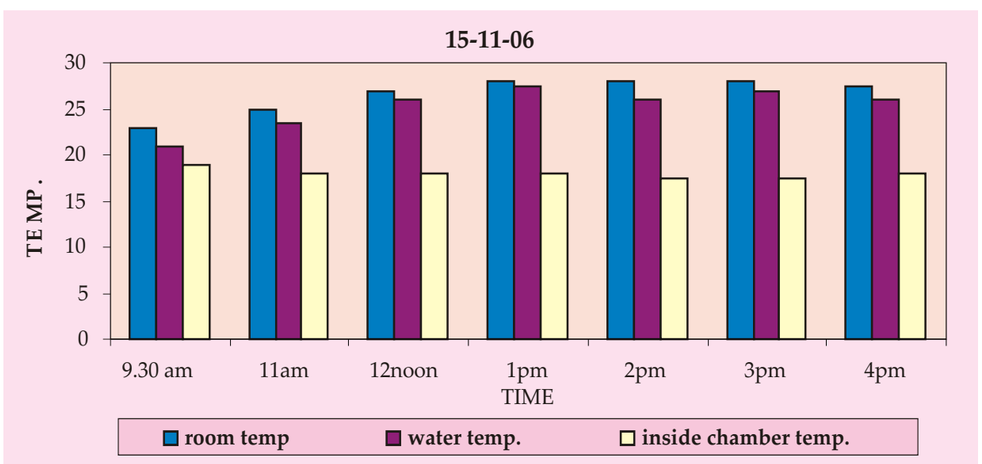
The above equation states that greater degree of cooling could be achieved if:

1 Air circulation speed increased
2 Dryness of air increased
3 The pore size become finer
4 The relative density is less
5 The water is evaporated effectively i.e. minimum water film thickness on the pores

TEMPERATURE MEASUREMENTS OF CLIMATIZER

The cooling effect is about 6-11°C (with respect to feed water temperature) at air velocity of 7 to 18 Km/sec and relative humidity of 50%.

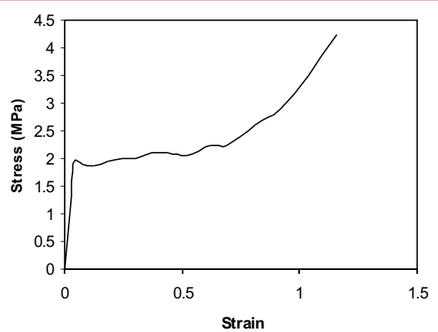
A climatizer of chamber size 300 mm x 300 mm x 300 mm is made and water is fed from the top surface of the foam panel. The temperature of the chamber, atmosphere and the circulating water are monitored. A typical histogram depicts the recorded temperatures at different time during day time. It is noted that the inside temperature is reduced by 7-12°C with respect to the atmospheric temperature.



CRASH BOX

Metallic foams are a new class of material with porous (cellular) structure. The pores may be interconnected (open) or closed in nature depending on the process used for their synthesis. Because of porous structure, the metallic foam exhibits very low density. (0.05-0.6 g/cc). One can design and then synthesize metal foam as per the application. Metallic foam exhibits significantly higher specific stiffness and strength as compared to a sound metallic material.

In addition, they exhibit significantly higher damping capacity as compared to the solid metal. Metal foam has typical stress-strain diagram which indicates that the foam materials densify at constant plateau stress. Such type of material can absorb substantial amount of impact energy without enhancing the stress level. Because of this, the metal foam can be used as blast protection for defense application, crash box in automobile industries.

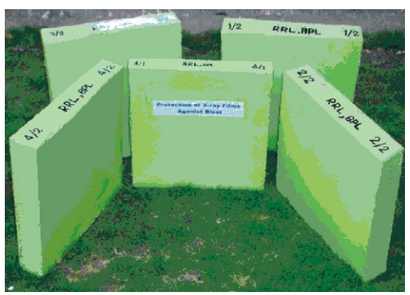


Stress-strain diagram of Al foam

Crash Box

Table: Variation of crash box weight as a function of vehicle speed and plateau stress.

Weight of Vehicle (Kg)	Velocity (m)	Plateau Stress s_{pl} (Mpa)	Thickness of Al Tube (mm)	Diameter of foam insert (mm)	strain	Length of box (m)	Yield stress of Al tube (MPa)	Density of Al (gm/cc)	Density of Metal foam (gm/cc)	Weight of Crash box (gm)
1000	2.00E+04	2	2	100	0.5	0.192901	150	2.7	0.54	1458.333
1000	2.00E+04	3	2	100	0.5	0.171468	150	2.7	0.54	1296.296
1000	2.00E+04	4	2	100	0.5	0.154321	150	2.7	0.54	1166.667
1000	2.00E+04	5	2	100	0.5	0.140292	150	2.7	0.54	1060.606
1000	2.00E+04	6	2	100	0.5	0.128601	150	2.7	0.54	972.2222
1000	2.00E+04	7	2	100	0.5	0.118708	150	2.7	0.54	897.4359
1000	2.00E+04	8	2	100	0.5	0.110229	150	2.7	0.54	833.3333
1000	3.00E+04	2	2	100	0.5	0.434028	150	2.7	0.54	3281.25
1000	3.00E+04	3	2	100	0.5	0.385802	150	2.7	0.54	2916.667
1000	3.00E+04	4	2	100	0.5	0.347222	150	2.7	0.54	2625
1000	3.00E+04	5	2	100	0.5	0.315657	150	2.7	0.54	2386.364
1000	3.00E+04	6	2	100	0.5	0.289352	150	2.7	0.54	2187.5
1000	3.00E+04	7	2	100	0.5	0.267094	150	2.7	0.54	2019.231
1000	3.00E+04	8	2	100	0.5	0.248016	150	2.7	0.54	1875
1000	3.00E+04									



Blast Resistant Panels

Al foam is attached with steel buffer plate to make blast resistant panels. The blast will create an impulse which is absorbed by the panels and minimize destructive action.

Properties

- Relative density: 0.10 - 0.15
- Plateau stress: 2 - 6 MPa
- Densification strain: 60 - 70 %
- Energy absorption: 1-3 MJ/m3
- Aluminium foam panels attached at the back of steel buffer plate
- The blast will create an impulse at the front steel plate. Major portion of the impulse would be absorbed by the steel plate
- Aluminium foam panel attached with steel plate would absorb the impulse
- The dimensions of the steel plate and aluminium foam could be designed as per the requirement

CALCULATION OF ENERGY ABSORPTION AND BLAST PROTECTION BY ALUMINIUM CELLULAR MATERIAL

Material: 2014-10wt%SiCp Composite Foam
Density: 0.42-0.45
Average Plateau stress: 4MPa
Average Densification strain: 0.5
The blast will create an impulse on the front steel plate. Due to the impulse the steel plate will acquire a velocity given by the following equation:

$V = J/d_s * b$ **(i)**

where b is the thickness of the steel plate and ds is the density of the steel
The velocity of steel plate will provide a kinetic energy on the foam slab. The kinetic energy can be calculated using following equation:

$U = 0.5\, d_s * b * V$ **(ii)**

The energy must be dissipated by the foam structure of thickness H.
The energy absorption by the foam

$U(f) = pl \times d = 2\ MJ/m^3$ **(iii)**

pl = plateau stress
d = densification strain
Total energy absorption by the foam :

$U(t) = U(f) * h$ **(iv)**

Where h is the thickness of the foam slab.
Equating equations (ii) and **(iv)**

$J = (2 * U(t) * d_s * b)^{0.5}$ **(v)**

Sl.No.	L(cm)	B(cm)	H(cm)	V (cc) (LxBxH)	D (gm/cc)	W (MJ/m^3)	J(Ns/m^2)
1	32	32	2.5	2560	0.51	2.0	1256
2	32	30	2.5	2400	0.45	2.0	1256
3	32	31	2.5	2480	0.42	2.0	1256
4	32	29	2.5	2320	0.43	2.0	1256
5	32	30	2.5	2400	0.47	2.0	1256
6	32	30	5	4800	0.41	2.0	1777
7	31	32	5	4882	0.43	2.0	1777
8	31.5	29	5	4568	0.47	2.0	1777
9	32	29	5	4060	0.51	2.0	1777
10	32	31	5	4650	0.42	2.0	1777

Potential Applications

(i) Blast resistance panels
(ii) Al-Foam sandwich panel for structural applications
(iii) Noise and vibration attenuation
(iv) Heat exchanger as well as heat insulators
(v) Insert for automobile door panels
(vi) Automobile bulk head as fire retardant
(vii) Bumper casing
(viii) Foam filled tubes in the chassis for crash-worthiness
(ix) Foam panels as bonnets
(x) Decorative furniture
(xi) Crashworthy sheet frames in automobiles and aerospace
(xii) Electronic packaging

All the above studies were carried out at the laboratory scale and then the identified process will be developed at the pilot scale prior to commercialization. Attempts will be made to interact with user industries and agencies which could be our partner for commercialization of the developed technology.

Non Toxic X-ray and Gamma radiation shielding materials utilizing industrial Waste Red mud and Fly ash

Description

The application spectrum of radiation technology in the area of medicine, irradiation of foods/vegetables, agriculture, and nuclear reactor for power generation, research and industry is increasing day by day all over the world in the new millennium. Exposure to radiation above permissible limits is harmful to our environment and our bodies. Conventionally the lead and its compounds are used for shielding radiations, which are highly toxic in nature. Alternatively concrete is used for shielding radiations but it requires very high thickness for shielding radiations effectively. Therefore there is an urgent need to develop Non-toxic and effective shielding materials. To solve this problem AMPRI, Bhopal has developed new shielding materials which are non-toxic and are made using abundantly available industrial wastes namely red mud and fly ash.

Fig. 1.Shielding Samples

Significant Features of AMPRI'S Non-toxic shielding materials are as follows:

1. Non-Toxic Lead Free.
2. Shielding HVT
   For X- Ray --- " AS THIN AS LEAD"
   For Gamma Ray ---"60% LESS thickness than CONCRETE"
3. Significantly low value HVTs enables "BROAD Shielding application Spectrum".
   a) Diagnostic X-Ray and CT Scanner Installation
   b) Nuclear Reactors and Shipping Containers
   c) Strategic Shielding Applications
4. Fire Resistant 1350 ^{0}C
5. Cost Effective - Uses "NO COST RAW MATERIAL" i.e. Red mud

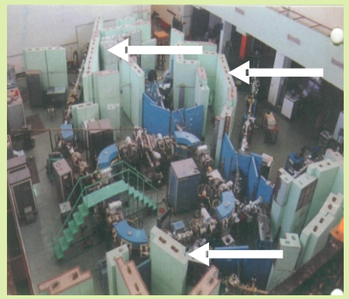


Fig. 2 Substitutes for concrete blocks in Nuclear and irradiation installations

Fig. 3 X-ray Shielding installations for whole body exposure to radiation.

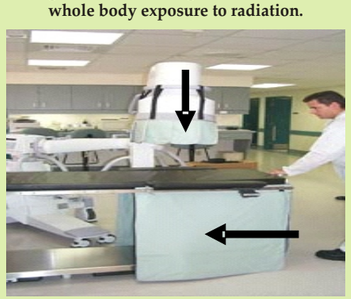


Fig. 4 Mobile Shielding units and curtains

Instant House

Today, human life is threatened by a number of casualties leading to heavy loss and destruction beyond our imagination. Emergency Preparedness Plan (EPP) for such situations is crucial for dealing with natural disasters like earthquakes, cyclones, floods etc. with well-planned approach leading to lesser damages and quick relief measures. The knowledge and application of what to do may help to save the lives of many families at crucial time of disasters. Disaster stress during these calamities may revive memories of prior trauma, leading to social, economic, spiritual, psychological, or medical problems. Such plans deal with preparedness questionnaires seeking information on how well prepared we are in the event of such natural disasters. This is an important step towards getting ourselves ready to meet eventualities, which might save lives of thousands of families in the event of disasters. These techniques also help human community to come out better during course of such disasters and should focus on measures of instant facilities and relief for disaster victims primarily

Instant House

in the form of instant house or shelter. These plans should also include basic amenities like water, sanitation, electricity etc. in the possible solutions to post disaster victims and their management.

The earthquake that hit western India on January 26,2001 caused unprecedented disaster, leaving about 20,000 people dead, more than 1,60,000 injured, and more than a million houses in ruins. Similarly on December 26, 2004 Tsunami struck the east coast of India leaving behind a large number of people who lost not only their houses but also their lives and family members. Similarly in October, 2005 a devastating earthquake hit Muzaffarabad area of Kashmir in Pakistan, leading to the loss of lives of thousands of families and their dwellings. Besides the earthquake, typical weather conditions prevailing in the region led to the loss of many lives as people could not be accommodated early at safe places. There are many examples of similar nature through out the world and such situations demand for immediate arrangements of basic facilities for the affected people. The trauma and the tragedy cannot be immediately overcome but at least basic post disaster help in the form of basic amenities can be made available to them.

The most priority based help would be to provide them shelter and roof for their relief and rehabilitation by developing an approach initially and then an actual low cost instant disaster house utilizing industrial wastes like fly ash, marble slurry etc. which shall completely eliminate the existing post-disaster house management crisis. Keeping in mind the above requirement, the need was felt for development of post disaster instant house which can be assembled quickly so that the affected people can be saved from post disaster situations including loss of life due to abnormal weather conditions. Moreover the developed product can be used for many other purposes as slum rehabilitation, site offices, picnic houses, emergency shelters, animal shelter, medical camps, rehabilitation shelter, school sheds, vocational training centers, toilet blocks and emergency food storage shelters.

Panels made of industrial waste and Natural Fiber Polymer Composite

GENERATION OF PROCESS and MICROSTRUCTURE MAPS

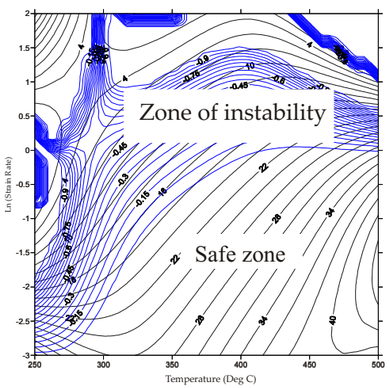
Objectives and Deliverables:

Cost effective technology @ Rs. **2425/- per m^2 plan area (Rs.225 per sqft. Plan area)**
Total cost is **Rs. 83800.00** for twin house unit of 34.56 sq.m.
Light weight structure, **approximately 40-45 kg/m^2 floor area** (Total weight **1380 kg** for twin house)
Easy to transport about **20 houses** at a time in a truck
Erection time **30 minutes** per twin house unit
Lightweight Fly ash-natural fiber composite sheets developed at **AMPRI, Bhopal** are used

Easy to assemble and disassemble with foldable options
Can be used as semi-permanent house like in case of slums, guard room at construction site, picnic purpose,
Use for making emergency shelters, animal shelter, medical camps, rehabilitation shelter, school sheds, vocational training centers, toilet blocks, emergency food storage shelters etc.
Termite, fungus, rot and rodent resistant material

Weather resistant and durable
Lightweight material used for walls & partitioning also absorbs & reduces seismic energy and its impact or effect.
Fruitful utilization of industrial waste **(Fly ash, Marble Slurry etc).**
Provision of basic amenities like water, kitchen platform, electricity, toilet etc,
Provision of interconnection so as to provide row houses in case where large numbers of peoples have to be accommodated

One of the major key issues involved during secondary deformation processing of materials is the processing temperature and the rate of deformation (strain rate). In addition, the degree of deformation in each step (strain) also becomes significant. The success of fabricating wrought products for engineering applications greatly depends on the employment of optimized processing parameters (temperature, strain rate and strain). These parameters are quite sensitive to the prior history of the starting material in terms of composition, (prior) deformation, microstructure etc. Accordingly, the processing parameters need to be optimized for to-be processed materials using deformation technique. A lot of trial and error experiments need to be conducted for optimizing the parameters on laboratory as well shop floor scale. With the help of recently developed insfrastructural facility (50 kN UTM), the (Process Modeling) group of the institute has been able to develop expertise in this direction. The whole exercise involves (a) compression testing of cylindrical samples at constant true strain rates



Generation of Process and Microstructure Maps

over a range of temperatures, strain rates and strains, (b) generation of iso-strain process maps using the flow stress data, (c) microstructural characterization of the starting and deformed sample, and (d) generation of microstructure maps corresponding to the process maps. The process maps generated using dynamic materials modeling provide a broad guideline about (i) the efficiency of power dissipation involved in bringing about microstructural changes during deformation and (ii) the range of temperature and strain rate causing instability and safe deformation. Microstructure maps delineate different microstructural evolutions/events taking place during deformation as a function of strain rate and temperature. Thus, with the help of process and microstructure maps, it becomes possible to more effectively select the optimized range of processing temperature and strain rate (and strain) to obtain desired microstructural features in the to-be (deformation) processed material. As a one step forward to this, it is also possible through FEM simulation and modeling studies (developed at the institute) to determine the optimized speed, degree and temperature of deformation to fabricate defect-free engineering components in actual applications. The developed expertise/concept, existing at very few places in the country, has been used on Mg alloys for automotive applications in a project funded by M/s General Motors, and on an Al alloy. One of the major key issues involved during secondary deformation processing of materials is the processing temperature and the rate of deformation (strain rate). In addition, the degree of deformation in each step (strain) also becomes significant. The success of fabricating wrought products for engineering applications greatly depends on the employment of optimized processing parameters (temperature, strain rate and strain). These parameters are quite sensitive to the prior history of the starting material in terms of composition, (prior) deformation, microstructure etc.

A general view of the UTM

Furnace with Test Assembly inside

CFD DESIGN, SIMULATION AND DEVELOPMENT IN MINERAL PROCESSING

AMPRI has taken up a major activity with the objective of development of lightweight metallic composite materials. In this project development of cenosphere and ultrafine ash filled composites are among the important activities. The engineering properties of such materials apart from the matrix material, process conditions are also dependent on the quality of cenospheres and ultrafine spheres. The mineral processing group is involved in recovery and purification of such materials from flyash using different process techniques. CFD design and simulation activities are being carried out for achieving such targeted materials through development of appropriate designs.

Computational Fluid Dynamics (CFD) techniques are increasingly important in understanding different engineering processes. The application of CFD techniques for design and process understanding is relatively new to mineral processing industry. Realizing the importance, AMPRI has developed a CFD center which has been involved in the development of CFD modeling, simulation and design activities in the area of mineral processing and related with the following objectives:

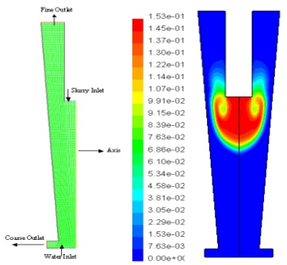
- Design & development of new unit operations
- Design improvement of existing systems for improved performance
- Trouble shooting the industrial problems
- Understanding the critical flow features of a process system

CFD Design, Simulation and Development in Mineral Processing

Salient activities carried out are elucidated:

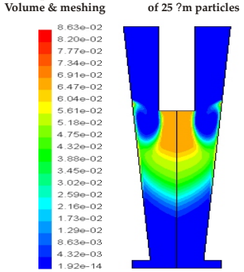
1. Vertical Current Classifier Design and Development through CFD Simulation - There has been a quest for design of classification systems with improved performance in terms of cut size and efficiency. A CFD design, modeling and simulation study was carried out on a vertical current classification system for improved performance at cut sizes between 45 and 100 microns. Design studies like changes in cone angle, height of column etc. were analyzed and based on the CFD results a physical model is developed for flyash classification which is proven to achieve required classification at higher efficiency.

SIMULATION RESULTS



Computational Volume & meshing

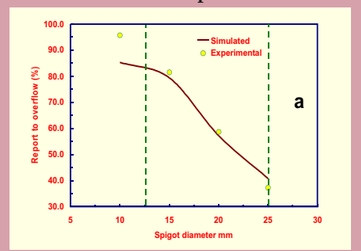
Volume fraction of 25 ?m particles

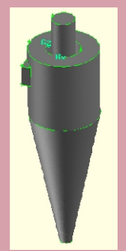


Volume fraction of 75 ?m particles

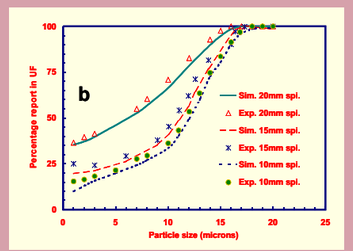
VERTICAL CURRENT CLASSIFIER

Water split





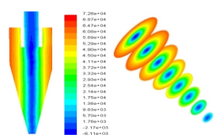
Particle distribution curves



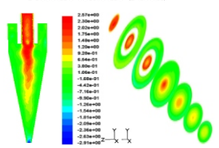
2. CFD Modelling and Simulation Studies on Hydrocyclone

Hydrocyclones are critical unit operations in mineral processing for classification at different sizes. Particle classification takes place inside highly swirling, turbulent, strained flows, through a balance between centrifugal and drag forces on particles developed due to free and forced vortex zones along the water body and air core. Though invented in late 18th century, understanding on the flow features is still a subject of development. CFD simulation methodology has been developed for performance prediction and further design development simulations. The salient results are as follows:

- Validation with water split characteristics
- Understanding on axial and tangential velocity profiles
- Quantification of free and forced vortex regions
- Air core quantification
- Particle distribution characteristics
- Design influence on the processing characteristics

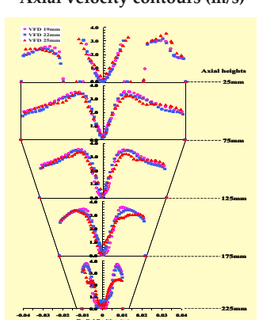


Pressure contours (Pascal)



Axial velocity contours (m/s)

Axial velocity contours (m/s)



Effect of Vortex finder on tangential velocity (m/s)

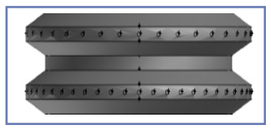
CFD Design, Simulation and Development in Mineral Processing

3. Understanding Thin Flowing Film Characteristics inside a Rotating Falcon Bowl:

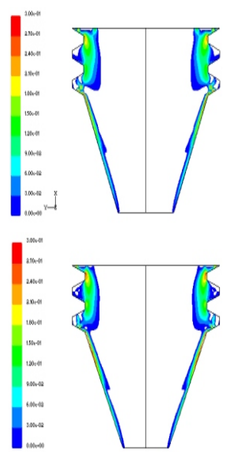
Falcon concentrator is an enhanced gravity concentration technique for recovering particles down to 1 microns by applying high G forces on particles. An unsteady state CFD Simulation was carried out to understand the flowing film behavior in such a separation bowl. The research finding have revealed important findings on film thickness on the flowing film region and in the fluidization zone, swirl and axial velocity profiles at different axial and radial positions within the film. The information will be useful in understanding the concentration mechanism and further on design developments.

A

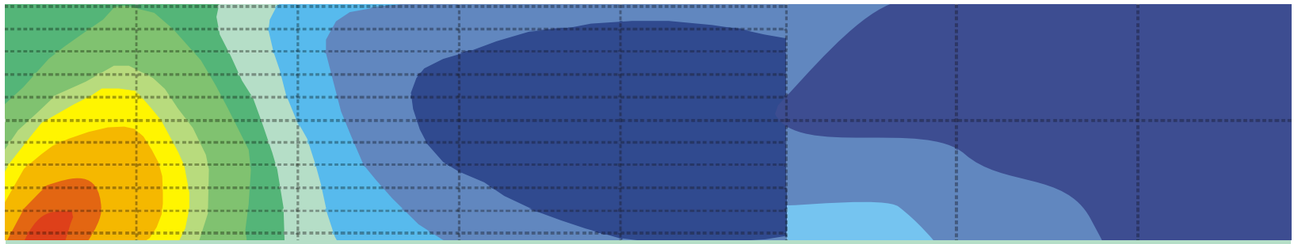
B



A. Falcon bowl meshing
B. Injection water holes



Positive vertical velocity (m/s)



प्रौद्योगिकियाँ/कौशल संबंधी जानकारी

Technologies/ Know-how

Wood substitute products from industrial wastes

Description

Natural fiber reinforced industrial wastes (red mud, Fly Ash, marble slurry dust) polymer composites as wood substitute products:

- Room temperature processing
- High strength to weight ratio
- Termite and corrosion resistant
- Self extinguishing and durable
- Cost effective


R-Wood doors


R-wood Doors


R-wood partition tile

R-wood tile

Wood substitute products from industrial wastes

Potential Applications

Versatile technology for building construction such as: Doors, windows & ventilators, partitions ceiling, flooring, panels, furniture, interior decoration, electrical applications

Actions Being Taken for Commercialization

For upscaling and customization of these products, a Technology Enabling Centre (TEC) has been setup at AMPRI Bhopal f or manufacturing R-wood products in semi batch process in continuous operation with the following objectives:

(i) Training of entrepreneurs
(ii) Commercialization and
(iii) Design and development of machinaries

Regular newspaper advertisement and organizing entrepreneur get-together-cum-workshop for commercialization of the technology to different entrepreneurs is being carried out.

R-Wood Sofa-set

Technology Enabling Centre for manufacturing R-Wood products at AMPRI

FRP Hopper for Hydro power plants

Description

BHEL, Bhopal is the manufacturer of Hydro power plants in India . In hydro generator, hopper controls the undesired flow of dust particles. The environmental efficiency of system improves by this hopper and piping system.

Presently used steel hoppers are heavy and therefore mounting, demounting adjustment alignment is difficult in the limited working space available in the hydro-generator plant. Steel hoppers are prone to corrosion. Moreover the present design of hopper allows the dust to go out.

To overcome the above problems, lightweight suitable FRP material has been optimized to replace heavy low-carbon steel used for hopper.

AMPRI, Bhopal and BHEL Bhopal have modified the design of the steel hopper and piping system to improve easy for operation and to suit FRP material. Apart from this AMPRI developed the material specifications and finalized modifications in design with BHEL. FRP hopper was fabricated with modified design to suit the fixing requirement for Tala Bhutan Power Plant under the joint supervision of BHEL and AMPRI and is fixed there.

FRP HOPPER FOR HYDRO POWER PLANTS

Potential Applications
For Hydrogenerators

In use by BHEL at present.

Inner view of FRP Hopper

Outer view of FRP hopper

CONFORMABLE PIPE SYSTEM FOR HYDRO GENERATORS

BHEL, Bhopal is the manufacturer of Hydro power plants in India. In hydro generator, piping system controls the cooling. This improves the efficiency of system.

Presently used MS pipes are heavy and rigid therefore mounting, demounting adjustment alignment is difficult in the limited working space available in the hydro-generator plant. These are very frequently replaced, which creates lot of problem

To overcome the above problems, material has been optimized to replace heavy rigid MS pipes.

AMPRI Bhopal and BHEL Bhopal have jointly modified the design of the existing steel pipe and its coupling system to improve easy for operation and fixing/replacements. Apart from this AMPRI /BHEL finalized the material specifications.

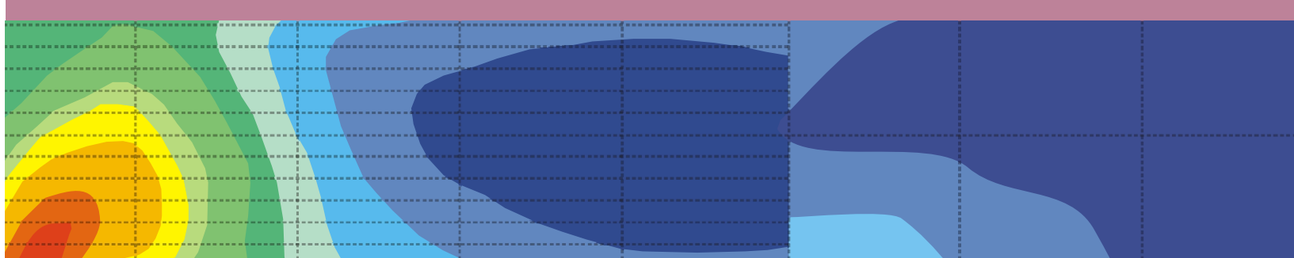
Conformable pipes of desired size and dimensions are fabricated for a power plant under the joint supervision of BHEL and AMPRI.

These pipes are coupled with socket and are fixed in power plant.

Conformable Pipe for Power Plants

Another Size conformable Pipe for Power Plant

विशेषज्ञता
Expertise



FLY ASH BASED COATING PAINT AND PIGMENT

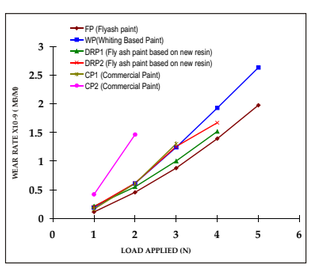
Lab scale process was developed by AMPRI Bhopal in making cost effective and better quality paints using Fly ash as an extender. This process and technology opens a new avenue for fly ash utilisation leading to partial replacement of conventional extenders like Calcite, China clay etc. This paint can be used in industrial maintenance coatings on metallic structures for corrosion protection in moderate to severe corrosive environments, as anti-abrasive coatings, as marine coatings. Recently, TATA, RDSO and BARC have approached AMPRI Bhopal for further collaboration work for commercialisation of this technology. This paves the way for a wider scope of utilizing fly ash as an extender in paints. The characteristics of paint prepared with fly ash has shown similar properties to that of commercially available formulations and also showed:

- Better resistance to abrasion and corrosion
- No adverse effect on film properties (drying time, thickness, brushability & gloss)
- No hard settling during storage

Fly ash as extender due to:

- Abrasive nature
- Less oil absorption (19%)
- Low specific gravity (2.1)
- Chemical inertness
- Loss in yield less than conventional materials
- Low cost, non-toxic and indigenous availability

Fly ash paint coated on MS steel plate



Wear rate versus load applied plots

EXTRUSION OF LIGHT MATERIALS

The experimental set up (Figure1) consists of the container, liner, die holder, die, spacer and punch. Cylindrical billets (50 mm diameter and 50 mm long) were used for extruding rods of diameter 15.5 mm. An extrusion ratio of 10:4 was maintained in all the cases while the extruded length was approximately 40 cm. The alloys were soaked for approximately 2 hours at the temperature of extrusion before extruding. To prevent heat loss during extrusion, the container, liner and billet were maintained at the extrusion temperature by externally heating the complete set up. Platen speeds can be varied between 50 mm/s and 0.1 mm/s; extrusions were carried out at temperatures between 300-400ºC. Different Al and Mg alloys were used for extrusion. Figure 2 shows a rod extruded using this set up facility.

A 400 tonne hydraulic press available at AMPRI, Bhopal was used to extrude Aluminium and Magnesium alloy billets into rods. A special extrusion set up was fabricated for the purpose. **With this added facility in the Hydraulic Press the institute has now acquired the expertise to extrude Mg and Al alloys.**

Figure 1: The hydraulic press along with complete extrusion set up

The arrangement is as follows: the die is arranged on the center of base frame of hydraulic press. The sleeve is put on this die and fixed. The liner is put in sleeves. Liner and sleeve are properly arranged so that there is no movement between these two. On this the container is put, so that it fully covered the set up. The temperature of container is same as that of furnace temperature of billet. The central hole of the die and liner are matched to precision. The container is fixed to the base plate by bolts so that it is not

Figure 2: Extruded Rod

displaced during experimentation. Two punches have been used for extrusion, one is fitted with upper frame of hydraulic press and other placed in liner. One spacer is placed on the billet so that proper force is applied on the billet.

A chain arrangement is used to lift the container along with liner and sleeve. One end of chain is fixed with upper frame of the hydraulic press with the help of bolt and the other end of chain was fixed with container. When extrusion process of rod is completed, the container is lifted so that extruded rod can be taken out.

POTENTIAL APPLICATIONS:
The light materials [alloys and composites] developed at AMPRI, Bhopal would find wider application only after processing them to products and in this respect extruded products find a number of applications in the automobile industries.

CHARACTERIZATION OF DUCTILE FRACTURE

Specimen level assessment:

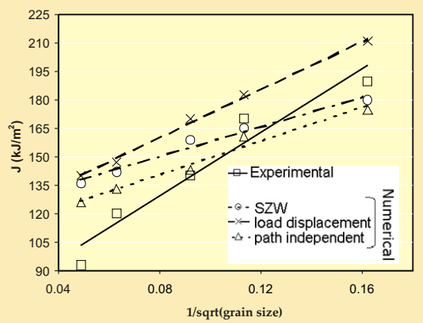
Several methods are in vogue to understand the process of crack initiation and propagation in ductile materials. In an attempt to achieve a unified understanding of these methods, these were studied using a finite element method based on large elasto-plastic deformation. In the current investigation, typical crack tip blunting prior to ductile fracture behaviour of standard CT specimens is simulated by FEM under mode-I loading. An attempt was made to understand methods Viz. 1) Load-displacement method ii) Path-integral method iii) Stretch zone width method. In load-displacement method, the study is carried out as a numerical experiment, that is, a complete CT specimen is subjected to loading as done in a real experiment and the determination of J is done akin to the experimental procedure. In the second analysis, the fracture toughness is caculated using path-integral method, which is well known. Thirdly, the occurrence of ductile fracture as accompanied by the presence of stretch zone at the crack tip, which has been used to characterize the fracture toughness, was measured. Following the above three procedures, the fracture toughness (J) is determined for different grain sized Armco iron as a function of load point displacement. In addition, an attempt has been made to establish the characteristic distance (l_c) correlation with fracture toughness. This method assumes a special significance since it links the fracture toughness to the microscopic mechanism of ductile fracture. The investigation also examines the possibility of using tensile test data for the numerical determination of Stretch Zone Width using FEM analysis. The crack growth in fracture specimens is also simulated using Gurson-Tvergaard-Needleman model under monotonic loading.

Component level assessment:

Power plants piping components are subjected to large stresses and damage accumulation over a period of time can lead to ductile failure. The sensitive nature of these components requires a thorough understanding of the material failure mechanism and warrants reliable testing procedures for foolproof design. Design added by numerical analysis can lead to considerable saving of time and cost. Once the reliability of the numerical model is established it can be used to support the experimental results. A fracture criterion that could accurately predict failure would be a useful engineering tool both for the evaluation of structural integrity and the selection of materials. Complex structures may experience stress in some regions that exceed the elastic limit necessitating a fracture criterion that would also include elastic-plastic behavior. In ductile materials the crack initiation and stable crack growth are usually described by J-resistance curve obtained from standard fracture specimens. The application of fracture toughness data that are obtained from high-constraint specimens to the low-constraint geometries often introduces high degree of conservatism in the prediction analysis or vice versa. This uncertainty in the approximation could severely influence the failure prediction at component level. Thus it is important to see how accurately one can predict the two aforementioned stages for leak-before-break demonstration. The work carried out to analyze the influence of some of these factors on the prediction of crack initiation and maximum load or instability stage in piping components of power plants. Work done also includes the prediction of fatigue cycles required for crack initiation, growth and appearance of through-thickness crack growth in components

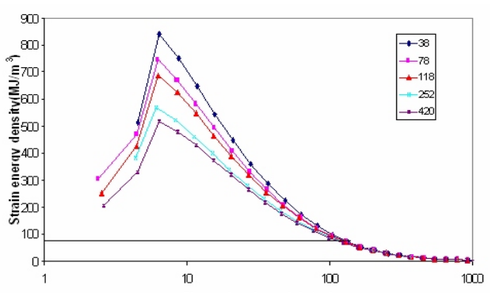
Experimental Facilities

The test facilities are available to conduct the fracture toughness (K_{1C} & J_{1C}) test of Compact Tension (CT) specimen and Three Point Bend (TPB) bar specimens. The fracture surface can also be observed on Scanning Electron Microscope. Facilities for Fatigue and fatigue crack growth test as per ASTM standards are also available.

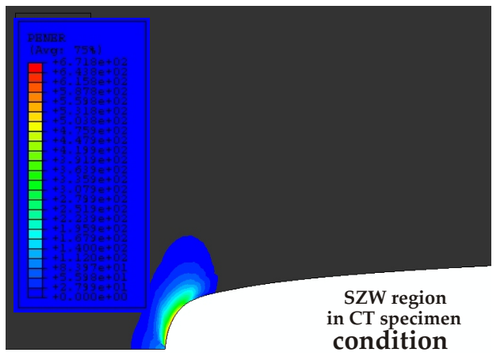


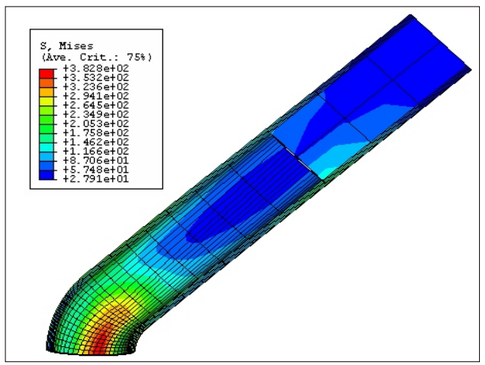
Comparison of Fracture Toughness using various methods

Shimadzu Servo -Hydraulic Machine (UTM 200kN capacity)

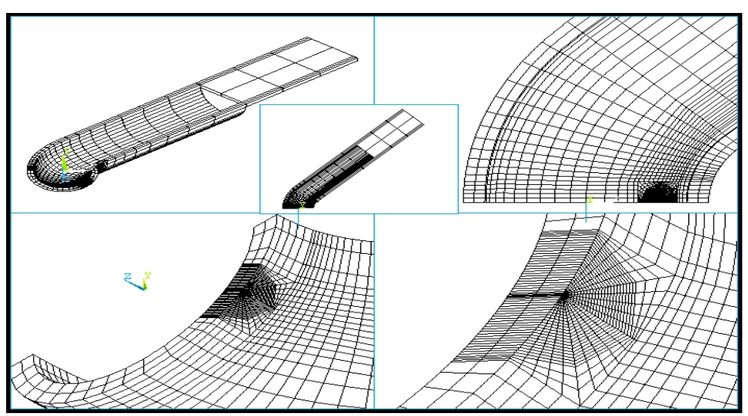


Determination of "characteristic distance"

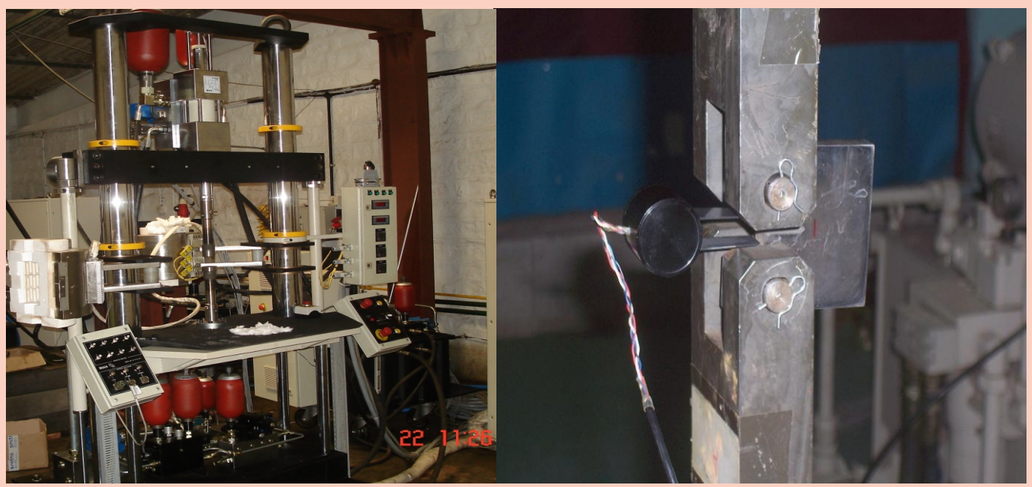




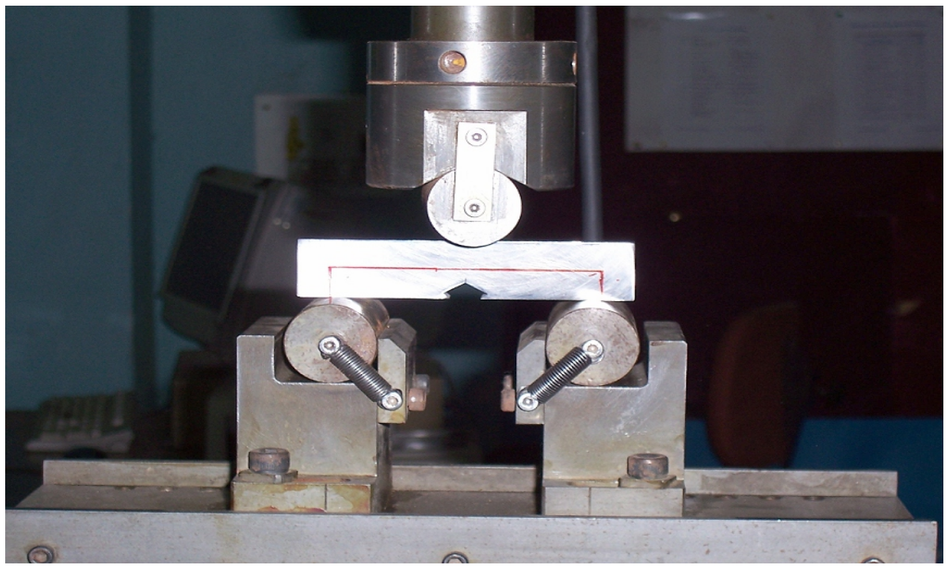
Assessment of crack initiation load in smooth elbow component



Fracture assessment of cracked piping component



CT specimen Testing



TPB Bar Specimen Testing

POTENTIAL APPLICATIONS

- Assessment of Material's Fracture Toughness.
- Simulation of crack growth in fracture specimens.
- Assessment of cracked component fracture behavior.
- Assessment of crack initiation location and life of the component.
- Assessment of crack growth behavior and life of the component.
- Assessment of ductile fracture.

OPTIMIZATION OF CLEAN COAL PRODUCTION

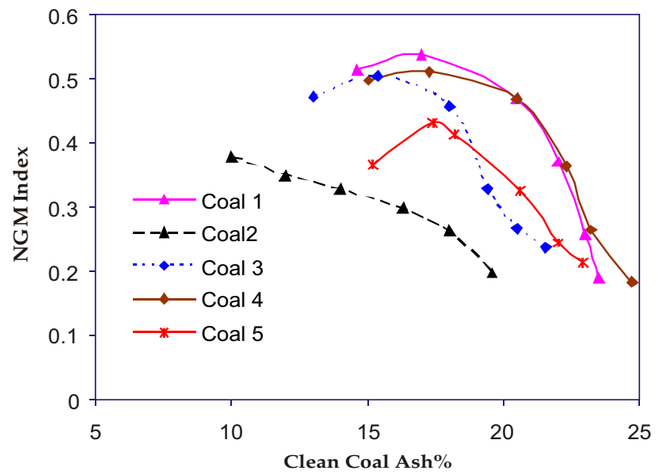
Development of a New Coal Wash ability Index

Gravity concentration is the major unit operation in any coal washing plant. Most of the existing Indian coal washing plants were designed long back based on the available coal wash ability characteristics at that time. However, due to the change in the mining technologies and frequent changes in the source of run-of-mine coal, the existing coal washing plants are facing difficulties to optimize the clean coal production. A new coal wash ability index has, therefore, been developed from the float-sink data of raw coal to help the plant managers to make strategic decisions towards performance optimization of the gravity concentration circuits. The developed index has the following advantages:

(1) This index, termed as NGMI, gives detailed information on wash ability characteristics of coal.
(2) Varies from 0 to 1 for the 'easiest washing' to 'unwashable' coal respectively, thus helps in quick interpretation.
(3) Varies with the specific gravity of separation or the clean coal ash content, thus helps in identifying the appropriate specific gravity of separation to better control the gravity concentration unit operation.
(4) When the NGMI values calculated for different coals are plotted as a function of either specific gravity of separation or clean coal ash content, it is easier to compare the wash ability characteristics of those coals quantitatively.
(5) Decisions on blending different coals to maximize the yield of clean coal at desired ash contents are also possible.

A sample plot of NGMI as a function of clean coal ash contents of five different coals are shown in the figure below.

In the recent past, this division has prepared a few comprehensive coal washability reports for the relevant industries based on this new index.



NGMI vs Clean Coal Ash Contents

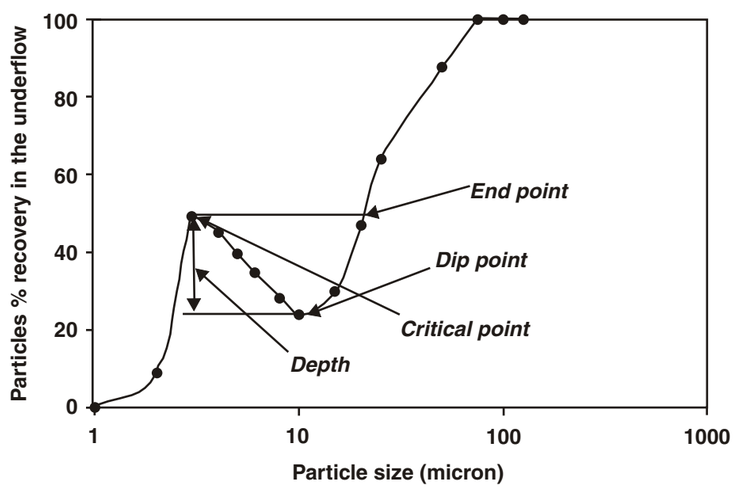
Development of a New Approach to Evaluate the Performance of Gravity-Based Coal Washing Equipment

A new method for performance evaluation of gravity-based coal cleaning unit operations has been developed. This consists of evaluating the nature and the amount of misplaced particles in the clean coal fraction. The proposed performance parameters 'Misplacement 1' and 'Misplacement 2' vary from 0 to 1 and therefore, it is easier to compare the performance of various equipments on a simple common scale to process a typical coal. It takes into consideration, the ash distribution of the misplaced particles to facilitate direct comparison of various gravity equipments as well as identifying their optimum operating conditions. The concept and the methodology to evaluate the proposed performance criterion have been discussed in an international article. Using this new methodology, the optimization of the gravity circuits in a coal washing plant with changing feed coal characteristics can be done easily. It is also possible to audit the performance of an existing coal washing plant quickly based on this methodology.

CFD Design, Simulation and Development in Mineral Processing Fine Particle Classification

Hydrocyclones are normally used to classify fine particles. In a hydrocyclone it is expected that relatively finer particles (i.e. ultra fine particles) in an assemblage of fine and ultra fine particles will report in the overflow. However, many people have reported that the recovery of ultra fine particles in a hydrocyclone underflow increases with decrease in particle size beyond a critical particle size, known as “fish-hook” effect. This critical particle size varies with the nature and characteristics of particles to be classified. But none could explain whether this irregular behaviour with ultra fine particle sizes in a hydrocyclone is a characteristic phenomenon or not. It is also interesting to note that none could give any indication whether the similar fish-hook effect will be observed while processing ultra fine particles in any centrifugal force field.

For the first time, it has been proved that the frequently observed fish-hook effect in a hydrocyclone classifier is a natural behaviour of ultra fine particles, in a centrifugal force field, due to the sudden drop in relatively coarser particles settling velocities based on Reynolds Number restrictions. It has also been concluded that the fish-hook effect will be observed in any centrifugal classifier or separator while treating fine and ultra fine particles based on the Reynolds number of individual particle classes (based on density and particle size variations). These findings will definitely help the concerned industries to better design their relevant fine particle classification circuits. A sample plot showing a fish-hook and some proposed nomenclatures to describe the shape of it in quantifiable terms is given.



4. Fine Coal Processing Using Centrifugal Separators

Coal fines (below 0.5 mm) are generally processed using the froth flotation technique. However, use of costly chemicals makes the process cost intensive and creates environmental problems. Centrifugal separators work on the principle of gravity concentration in a centrifugal force field and therefore, there is no requirement of chemicals. This division has developed expertise in selecting an appropriate centrifugal separator, through hydrodynamic modelling, to process coal fines of different washability characteristics. The basic understanding of the particles separation mechanism inside various centrifugal separators will also help in identifying appropriate designs and the suitable operating conditions to process other fine particles too. It has also been demonstrated that the performance of a water-only-cyclone depends on the ash distribution and the volume per cent distribution of the particles below 25 microns in the coal fines.

MICROFLUIDICS AND MEMS

The Expertise developed include:

Application of micro and nano fluidics for clinical diagnosis and Separation of biomolecules using micro/ nano fluidics

They can be defined as:

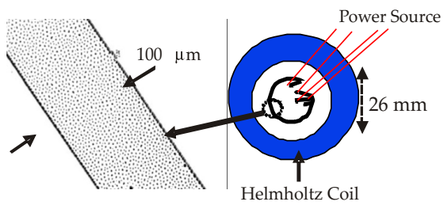
I. Designing of microfluidic channels for diagnostic systems.
II. Surface modification of micochannels for biocompatibility.
III. Fabrication of microfluidic channels on polymer substrate.
IV. Separation optimisation for biomolecules separation.
V. Development of separation matrices such as seiving polymer matrices, ferro magnetic matrices etc.
VI. Development of detection tools for bio molecules.

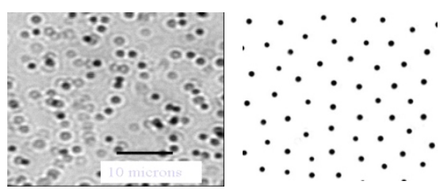
This work leads to Downscaling methodologies, low sample and reagent consumption, easier automation, higher throughput and simpler integration in the field of clinical diagnostics.

Applications include medical/agricultural/pharamceutical/other areas:
DNA, protein and peptide analysis, environmental monitoring, chemiclal warfare analysis and development of new drugs.

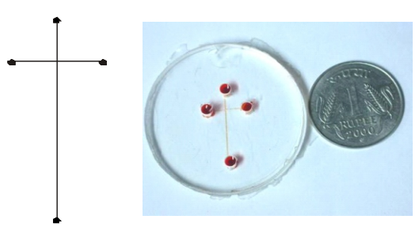
This expertise is aimed at the development of:

a) Microchip based diagnostic system for neurotransmitters study
b) Separation of specific proteins, peptides and DNA molecules

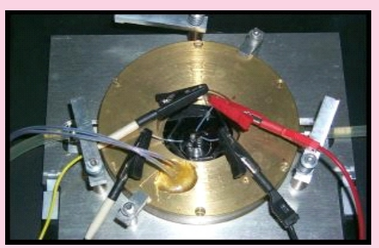


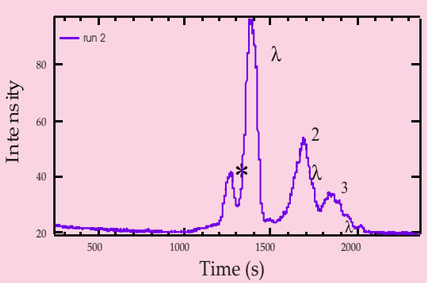


Self-organizing magnetic particles

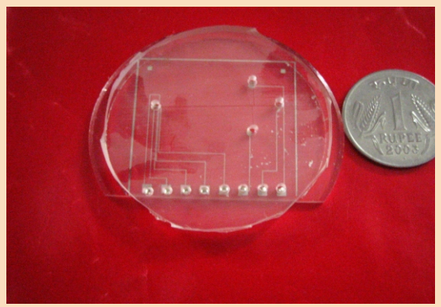
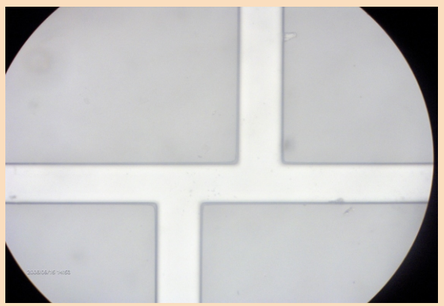
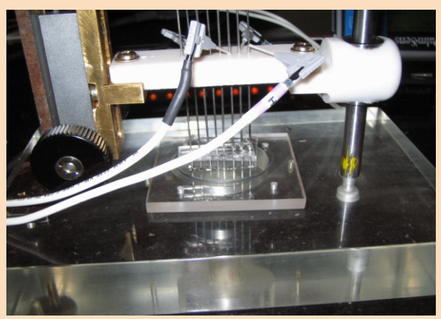
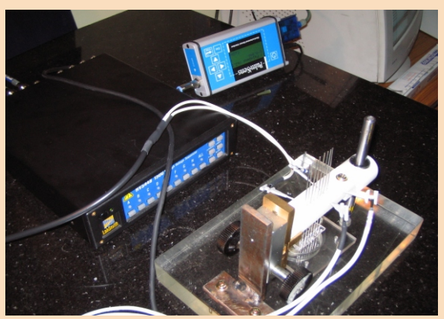


Magnetic Coil With Cell





Separation of Large DNA: DNA Multimers, Same Separation Takes 15+ hours in Pulsed Field Gel Electrophoresis

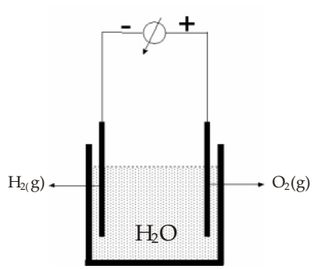





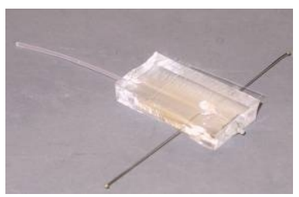
Lab-on-a-chip device for dopamine analysis

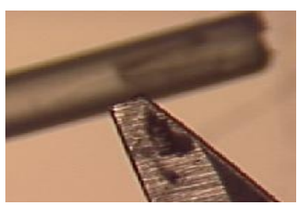
Micro-pump: water based pumping system

$2H_2O \rightarrow O_2(g) + 4H^+ + 4e^-$

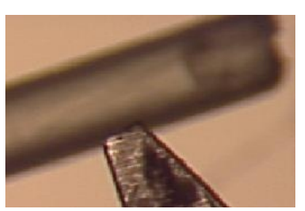
$2H_2O + 2e^- \rightarrow H_2(g) + 2OH^-$



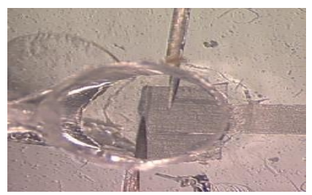




4v-0 minutes



4v-after 1 minutes



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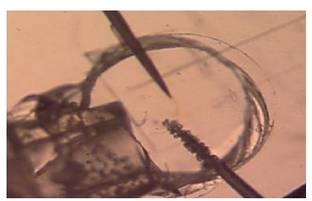

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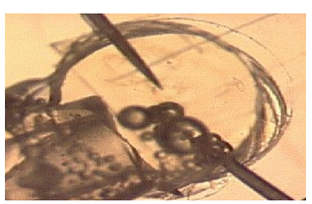
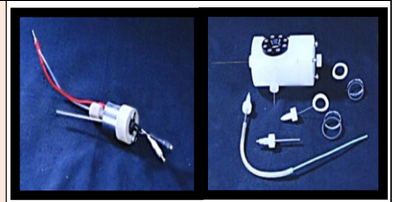
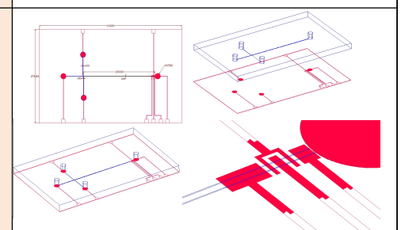
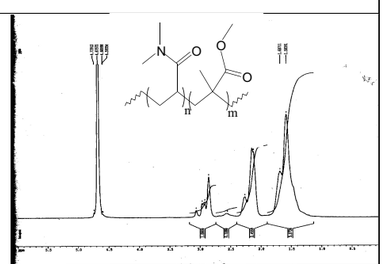


2 v

Expertise	Target	*Product/Process developed*
Detection in Miniaturized Separation Systems	Fluorescence Derivatives, Electrochemical Detector, Post-Column Reactor, Application for Analysis of Environmental & biological samples.	
Microfluidics & MEMS	Micro Total Analysis System (microfluidic channel, injection system, pump, valve, reactor, detector)	
Surface modification of micro channels	Synthesis, characterization and applications of copolymers for the surface treatment of capillaries/ microchips.	

Nano materials and Nano devices for application in clinical diagnosis.The Process is under development stage.

FLY ASH UTILISATION FOR WASTELAND

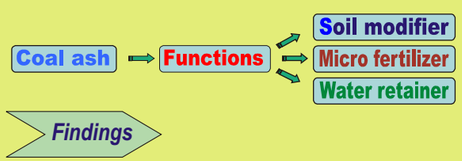
Based on the lab scale experiments, the technique was successfully demonstrated at large scale at various part of the country like:

- National Thermal Power Corporation, Rihand Nagar, Uttar Pradesh
- Parichha (Jhansi) and Panki (Kanpur) Thermal Power Station, U.P
- Madhya Pradesh Electricity Board, Sarni, Madhya Pradesh
- National Aluminium Company Ltd, Angul and Damanjodi Orissa.

Coal Ash Application: A suitable Medium to enrich the soil fertility

Achievement

- About 40 acres of wasteland converted into fertile land
- Demonstrated in 30 farmers' field in around 60 acres of land
- Confidence and awareness generated and trained about 600 farmers at different parts of the country like Angul, Damanjodi, Rihand Nagar, Sarni, Jhansi and Kanpur
- About 65 farmers adopted the technology
- Long term studies confirmed great potential for use of fly ash in agriculture without harming Mother Earth



Findings

Optimum Fly Ash Dose: 300 t/ha.

- Seed germination faster 22-35%
- Crop Growth 2 lield increased 16-21%
- Irrigation water saving is 30%
- Food produced : Meeting the quality standard.

DEVELOPMENT AND AGRICULTURE

The outcome of the R&D work contributed in developing confidence to farmers, villagers and common mass on use of fly ash to improve the agriculture productivity. Presently mass scale fly ash application to improve the agricultural productivity is being implemented by the farmers in their own land at Jhansi, Kanpur, Angul Orissa and Sarni, M.P. In India, during electricity generation, thermal power plant releases ~ 118 (2006-2007) million tonnes of fly ash and become a major concern to effectively manage this huge quantities to safeguard the environment. The technologies developed and demonstrated showed significant utilisation potentials of fly ash followed by increasing the employment opportunity and economy of the rural people.

Groundnut crop at TPS Jhansi, U.P.

Wheat crop at MPEB, Sarni, M.P.

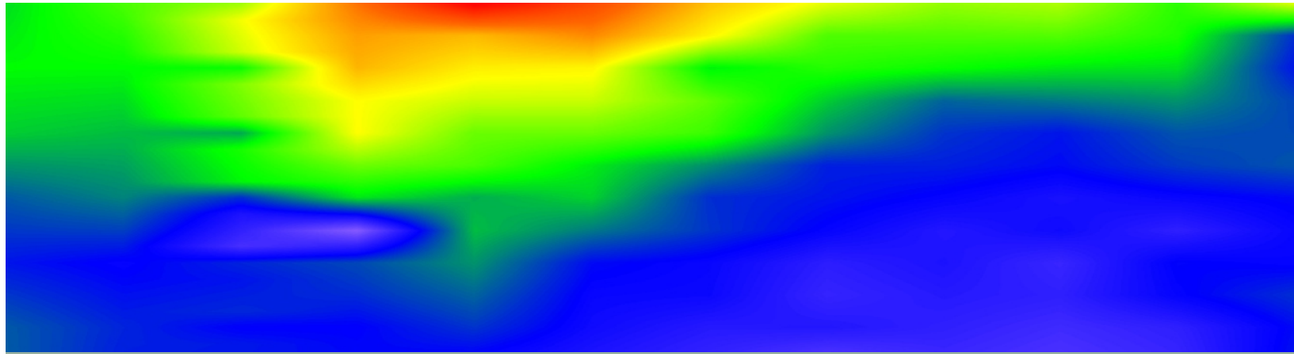
Sunflower crop at NALCO, Orissa

Kisan Mela at NALCO, Orissa

Wheat crop at Kanpur

Sunflower and wheat crop at Rihand Nagar

Cultivation of various crops, vegetables and cereals on fly ash amended soil at different part of the country



सामान्य जानकारी
General Information

Research Council

Shri A. C. Wadhawan Chairman & Managing Director Industrial & Environment Management Service 3, Kautilya Marg, Chanakyapuri New Delhi - 110 021	**Chairman**
Prof. P. Ramachandra Rao Vice-Chancellor Banaras Hindu University Varanasi - 221 005	**Member**
Prof. H. P. Garg Director General M.P.Council of Science and Technology Vigyan Bhawan, Science Hills, Nehru Nagar Bhopal - 462 003	**Member**
Shri P. T. Deo Executive Director Bharat Heavy Electricals Limited Bhopal - 462 022	**Member**
Dr. N. Ramakrishnan Director AMPRI, Bhopal	**Member**

Dr. G. Sundararajan Director International Advanced Research Centre for Powder Metallurgy and New Materials(ARCI) Balapur Post Office, Hyderabad 500 005	**Member**
Representative of Secretary, **Deptt. of Science and Technology** (Agency Representative) Technology Bhawan, New Mehrauli Road New Delhi 110 016	**Member**
Dr. Gangan Pratap Scientist-in-Charge CSIR Centre for Mathematical Modeling and Computer Simulation (C-MMACS) NAL Belur Campus, Bangalore 560 037	**Member**
Dr. B. B. Dhar Ex Director CMRI Sr. Vice-President , Ritanand Balved Education Society E 27, Defence Colony, New Delhi 110024	**DG's Nominee**
Dr. C. B. Raju **Scientist** AMPRI, Bhopal	**Member Secretary**

Management Council

01-7-2003 to 30-6-2005

1 .	**Director,** AMPRI Bhopal	**Chairman**
2.	**Dr. R. N. Yadava,** Scientist Gr. IV (5)	**Member**
3.	**Dr. O. P. Modi,** Scientist Gr. IV (1)	**Member**
4.	**Sh. R. S. Ahirwar,** Scientist Gr. IV (2)	**Member**
5.	**Dr. (Ms.) Rupa Dasgupta,** Scientist Gr. IV (3)	**Member**
6.	**Dr. (Ms.) Sorna Gowri,** TO, Gr. III (1)	**Member**
7.	**Dr. A. K. Gupta,** Scientist Gr. IV (6) NPL, NEW Delhi	**Member**
8.	**Sh. P. D. Ekbote,** Scientist Gr. IV (4) & Head, Project Monitoring & Coordination Cell	**Member**
9.	**Sr. F & AO/ F & AO**	**Member**
10.	**COA**	**Member**

Management Council

01-7-2005 to 30-6-2007

1 .	**Director,** AMPRI Bhopal	**Chairman**
2.	**Dr. K. Basu,** Scientist 'G'	**Member**
3.	**Shri S. A. R. Hashmi,** Scientist 'E-II'	**Member**
4.	**Shri P. Ashokan,** Scientist 'E-I'	**Member**
5.	**Dr. Deepti Mishra,** Scientist 'C'	**Member**
6.	**Dr. C. Padmakar,** Technical Officer 'A'	**Member**
7.	**Dr. Anil Gupta,** Scientist 'G' NPL, New Delhi	**Member**
8.	**Dr. Swati Lahiri,** Scientist 'E-II'	**Member**
9.	**F & AO**	**Member**
10.	**COA**	**Member Secretary**

R & D Alliances

Industries

Associated Cement Ltd.; AFCONS Infrastructure Ltd.; BHEL, Bhopal; GNVFC; GMICS Ltd., Gujrat; Indian Oil Corpn.; Kochi Refineries Ltd.; Keystone Industries Ltd, Bhilai; Nuclear Power Corporation; NALCO; OPM, Amlai; Petronet VK Ltd., Gujrat; Reliance Industries Ltd., Mumbai; Sverdrup Civil Inc. , Bhopal

International Agencies

General Motors, USA, Indo-French Center For Promotion of Advance Research(IFCPAR), UNICEF, Russian Academy of Sciences(RAS)

Government Agencies/Institutions

Aeronautics R&D Board; Armament Research Board(ARB); Defence Research and Development Organisation(DRDO), New Delhi; Building Materials and Technology Promotion Council(BMTPC); Central Power Research Institute(CPRI); Center Mine Planning & Design Institute Limited(CMPDIL), Ranchi; Department of Science and Technology(DST), New Delhi; Fly Ash Mission ,TIFAC , New Delhi; Gujarat Mineral Development Corporation(GMDC) Ltd., Ahmedabad; Indian School of Mines(ISM), Dhanbad; Madhya Pradesh Electricity Board(MPEB); Ministry of Environment and Forests(MoEF), GoI; National Remote Sensing Agency(NRSA), Hyderabad; National Minerals Development Corporation(NMDC), Hyderabad. Uttar Pradesh RajyaVidyut Utpadan Nigam Limited (UPRVUNL); Board of Research in Nuclear Science(BRNS), Mumbai; Security Paper Mills, Hoshangabad; Rajasthan State Mines and Minerals Limited(RSSML), Udaipur; Madhya Pradesh Rural Livelihood Project (MPRLP)

MEMORANDUM OF UNDERSTANDING SIGNED

July 20, 2005
APS University, Rewa, Madhya Pradesh & RRL, Bhopal

The MoU was signed for the facilitation of cooperation and coordination and the utilization of complementary federal facilities and capabilities.

January 14, 2006
Institute of Regions Arides, Tunisia and RRL, Bhopal

The MoU was signed with a background for Contribution to a continuous development of scientific and didactic cooperation between the two institutes with an aim to increase their scientific and cultural contacts.

July 11, 2006
Ashok Leyland Ltd, Chennai

MoU signed between AMPRI,Bhopal and Ashok Leyland Ltd, Chennai to work in the areas of design and FEM simulation of gray cast iron cylinder head, Development of MMC brake drum and process improvement in sand casting against moisture protection.

January 17, 2007
Centre for Research and Industrial Staff Performance (CRISP)

An MoU was signed between Center for Research and Industrial Staff Performance(CRISP) and AMPRI, Bhopal to facilitate utilization of facilities for mutual benefits. The facilities available in CRISP include development of different test specimens, components and die assemblies and design of components using CAD. These facilities will be useful for collaborative developmental work in the field of fabrication of different components, die assemblies, machining and training.

MoU with CRISP

Research Papers published in Refereed Impact Journals

1. Manjusha Shelke, S.K. Sanghi, Amit Asthana, Sushma Lamba, Meenakshi Sharma. Fast seperation and sensitive detection of carcinogenic aromatic amines by reversed phase liquid chromatography coupled with electrochemical detection. Journal of chromatography A, 1089 (2005) 52-58, **3.096.**

2. Sushma Lamba, Sunil Kumar Sanghi, Amit Asthana, Manjusha Shelke. Rapid determination of sulfonamides in millk using micellar electrokinetic chromatography with fluorescence detection Analytica Chimica Acta 552 (2005) 110-115, **2.760**

3. Asokan Pappu, Mohini Saxena, Shayam R. Asolekar. Jerosite characteristics and its utilization potentials ELSEVIER Science of the Total Environment 359 (2006) 232-243, **2.224**

4. Mohini Saxena, Lokesh Kumar Dhimole. Utilization and value addition of copper tailing as an extender for developent of paints ELSEVIER Journal of Hazardous Materials B129 (2006) 50-57, **1.544**

5. D. P. Mondal, S. Das, V. Rajput. Effect of zinc concentration and experimental parameters on high stress abrasive wear behaviour of A1-Zn alloys: A factorial design approach Material Science and Engineering A 406 (2005) 24-33,**1.347**

6. M.Singh, D.P. Mondal, S. Das. Abrasive wear response of aluminium alloy-sillimanite particle reinforced Composite under low stress condition Material Science and Engineering A 419 (2006) 59-68, **1.347**

7. D. P. Mondal, S. Das, R. N. Rao, M. Singh. Effect of SiC addition and running-in-wear on the slidding wear on the sliding wear behaviour of A1-Zn aluminium alloy Material Science and Engineering A 402 (2005) 307-319, **1.347**

8. K.Venkateshwarlu, Ajay Kumar Ray, Manoj Kumar Gunjan, D. P. Mondal, L. C. Pathak Tribological wear behavior of diamond reinforced composite coating Material Science and Engineering A 418 (2006) 357-363, **1.347**

9. Y. L. Saraswathi, S. Das, and D. P. Mondal Erosion-Corrosion Behavior of SiC Particle-Reinforced A1-Si Alloy in NaOH Slurry Metallurgical and Material Trasactions A Volume 36A, August 20052259, 1, **232**

10. S. A. R. Hashami, U. K. Dwivedi and N. Chand Friction and sliding wear of UHMWPE modified cotton fiber reinforced polyester composites Tribology Letters (2006) DOI:10.1007/s11249-006-9014-y, **1. 187**

11. B. K. Prasad Slurry wear behavior of zinc-based alloys: influence of some material and test parameters Tribology Letters, Vol.21,No.2.February 2006 DOI:10.1007/S11249-006-9026-7, **1.187**

12. S. A. R. Hashmi, U. K. Dwivedi, D. Jain, Ajay Naik, Navin Chand Graphite-Epoxy Graded Material by Centrifugation Journal of Applied Polymer Science, Vol.96, 550-556 (2005), **1.072**

13. S. A. R. Hashmi Attaining a Controlled Graded Distribution of Particles in polymerizing Fluid for Functionally Graded Materials Journal of Applied Polymer Science, Vol.99, 3009-3017 (2006), **1.072**

14. Navin Chand,Deepak Jain Effect of Temperature on Electrical Behavior of Flayash-Filled Epoxy Gradient Composites Journal of Applied Polymer Science, Vol.100, 1269-1276 (2006), **1.072**

15. D. P. Mondal, S. Das High Stress abrasive wear behavior of aluminium hard particle composites: Effect of experimental parameters, particle size and volume fraction ELSEVIER Tribology International 39 (2006) 470-478, **1.026**

16. Rupa Dasgupta, Humaira Meenai, Si-C particulate dispersed composite of am Al-Zn-Mg-Cu alloy: Property comparison With parent alloy ELSEVIER Materials Characterization 54 (2005) 438-445, **0.982**

17. K. Udaya Bhaskar, B. Govindarajan, J. P. Barnwal, K. K. Rao, B. K. Gupta, T. C. Rao Classification studies of lead-zinc ore fines using water-injection cyclone ELSEVIER International Journal of Minereal Processing 77 (2005) 80-94, **0.965**

18. A. K. Gupta, D. M. Jesudas, P. K. Das, K. Basu Performance Evaluation of different Types of Steel for Duck Foot Sweep Application ELSEVIER Biosystems Engineering(2004)88(1),63-74 DOI: 10.1016/j.biostemseng. 2004. 01.013 PM-Power and Machinery, **0.848**

19. B. K. Prasad, Effect of Heat Treatment on the lubricated sliding wear behavior of Zinc-based Alloy Containing nickel under barying test conditions Z. Metallkd. 96 (2005)11, **0.842**

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21. I. B. Singh, K. Chaturvedi, D. R. Singh and A. H. Yegneswaran, Thermal Stabilization of Metal Finishing Waste with Clay Environmental Technology, Vol.26 pp 877-883, 2005, **0.718**

22. K. K. Pathak, Apurva Sharma and S. Shrimanth, Elasto-plastic shape optimization of a cantilever beam Journal of Structural Engineering Vol. 32, No.6, February-March 2006 pp. 469-473, **0.707**

23. S. S. Amritphale, Sanjeev Bhasin, Navin Chandra, Energy efficient process for making pyrophy llite-based ceramic tiles using phosphoric acid and mineralizers ELSEVIER Ceramics International 32 (2006)181-187, **0.702**

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25. H. Shah, A. K. Mazumdar, J. P. Barnwal, Development of water split model for a 76 mm hydrocyclone ELSEVIER Minerals Engineering 19 (2006)102-104, **0.678**

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27. Navin Chandra, Nitin Agnihotri, Priya Sharma, Sanjeev Bhasin and S. S. Amritphale, Separation of lead ions from aqueous solutions by adsorption at talc surface Journal of Scientific & Industrial Research Vol.64, September 2005, pp. 674-678, **0.232**

28. I. B. Singh, G.Venkatachari, D. R. Singh, M. Singh & A. H. Yegneswaran, Effect of Cr(VI)-Fe (II) interaction on the corrosion resistances of iron at different Ph in dichromate solutions Indian Journal of Chemical Technology VpI.12, November 2005, pp.635-640, **0.226**

29. K. K. Pathak, Sanjay Panthi and N. Ramakrishanan, Application of Neural Network in Sheet Metal Bending Process Defence Science Journal, vol.55, No.2, April 2005, pp.125-131, **0.172**

30. S. A. R. Hashmi, Ajay Naik and Navin Chand, Effects of hybrid composition of LCP and glass fibers on abrasive wear of reinforced LLDPE Bull. Master. Sci.Vol.29, No.1, February 2006, pp.49-54, **0.165**

31. Sanjeev Saxena and D. S. Ramachandra Murthy, Elastic-Plastic Fracture Mechanics based Prediction of fracture instability in a circumferentially through-wall cracked pipe in bending Trans. Indian Inst. Met.Vol. 58, Nos. 2-3, April-June 2005, pp.461-466, **0.084**

32. Y. L. Saraswathi, S. Das, D. P. Mondal, Influence of microstructure and experimental parameters on the erosion-corrosion behavior of Al alloy composites. Materials Science & Engineering A 425 (2006) 244-54, **1.347**

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34. Rupa Dasgupta, Humaira Meenai, M.S.Yadav Microstructure evolution and phase precipitation on ageing AL-CU alloy. Int.J Microstructure and Materials properties, Vol. 1 No. 2, 2006.**New journal**

35. Rupa Dasgupta, Swati Lahiri, M.V.R.L. Murthy, A. K. Jha, Selecting an area for technological intervention in the rural sector in India. The Social Science Journal 36 (2007) 187-93, **0.150**

37. Pappu Asokan, Mohini Saxena, Shayam R. Asolekar, Hazardous Jarosite use in advance non-hazardous product for engineering application. Journal of Hazardous Materials B137 (2006) 1589-99,**1.544**

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39. B.K. Prasad, Investigation into sliding wear performance of zinc-based alloy reinforced with SiC particles in dry and lubricated conditions,Wear262 (2007), 262-73, **1.404.**

40. Gazala Ruhi, O. P. Modi, I. B. Singh, A. K. Jha, A. H. Yegneswaran, Wear and electrochemical characterization of soal-gel alumina coating on chemically pre-treated mild steel substrate .Surface & Coatings Technology201 (2006) 1866-72,**1.646**

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42. Sona Saxena, Murari Prasad, Stanislaus F. D'Souza, Radionuclide sorption onto low-cost mineral Adsorbent. Ind. Eng. Chem. Res 245, (2006) 9122-28,**1.312**

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45. Navin Cahand, U.K. Dwivedi, High stress abrasive wear study on bamboo Journal of materials processing technology, 183 (2007) 155-59, **0.592**

46. S.A.R. Hashmi, U.K. Dwivedi, Estimation of concentration of particles in polymerizing fluid during centrifugal casting of functionally graded polymer composites, Journal of Polymer Research (2007) 14: 75-81, **0.158**

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50. Sorna Gowri, Jean-Louis Viovy, Rafaele Attia, Claus Fitterer, Vers Une puce microfluidique pour la detection de mutations inconnues et le genotypage, LA Houille Blanck 2006, 5:40-44, **0.044**

51. Sanjeev Saxena, N. Ramakrishnan, A comparison of micro, meso and macroscale FEM analysis of ductile fracture in a CT specimen (Mode I) Computational Material Science39 (2007) 1-7,**1.494**

52. K.K. Pathak, D.K. Segal, Saleem Akhtar, S.S. Bhadauria, A review of structure shape optimization techniques, Journal of Structural Engineering, Vol.33. No.6 2007.505-14, **0.707**

53. S.K. Panthi, N. Ramakrishnan, K.K. Pathak, J.S. Chouhan, An analysis of spring back in sheet metal bending using finite method (FEM) Journal of Materials Processing Technology, 186 (2007)120-24, **0.592**

54 K. Uday Bhaskar, Y. Ramamurthy, M. Ravi Raju, Sumit Tiwari, J.K. Shrivastava, N. Ramakrishnan, CFD simulation and experimental validation studies on hydrocyclone Minerals Engineering20 (2007) 60-71, **0.678**

55. D.P. Mondal, N. Ramakrishnan, S. Das, FEM modeling of the interface and its effect on the elstio-plastic behavior of metal matrix composites, Material Science & Engineering A433 (2006) 286-290, **1.347**

56. D.P. Mondal, N. Ramakrishnana, N.V. Ganesh, V.S. Muneshwar, S. Das, Effeat of SiC concentration and strain rate on the compressive deformation behavior of 2014A1-SiCp composite, Materials Science & Engineering A433 (2006) 18-311. **347**

57. K. Venkateswarlu, S. Mohapatra, R.G. Rao, A.K. Ray, L.C. Pathak, D.P. Mondal, High abrasive wear response of diamond reinforced composite coating:a factorial design approach, Tribology Letters ,Vol 24 No. 1 (2006) **1.187**

58. B.K. Prasad, Sliding wear response of a cast iron under varying test environments and traversal speed and pressure conditions Wear 260(2006) 1333-41,**1.404**

59. O.P. Modi, B.K. Prasad, A.K. Jha, Influence of alumina dispersoid and test parameters on erosive wear behavior of cast zinc-aluminum alloy, Wear 260(2006) 895-902, **1.404**

60. J. P. Barnwal, A.K. Majumdar, B. Govindarajan, Modeling of coal flotation in a batch and continuous cell operation Coal Preparation, 26:123-136, 2006,**0.297**

61. A. K. Majumdar, H.Shah, J. P. Barnwal, Comparative study on managemegnetite medium stability in a vorsyl separator and in a heavy medium cyclone, Coal Preparation, 26:165-179, 2006, **0.297**

62. A.K. Majumdar, H. Shah, P. Shukla, J.P. Barnwal, Effect of operating variables on shape of "fish-hook" curves in cyclones, Minerals Engineering, 20 (2007)204-06, **0.678**

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64. O. P. Modi, Pallavi Pandit, D. P. Mondal, B. K. Prasad, A. H. Yegneswaran, A. Chrysanthou, High stress abrasive wear response of 0.2% carbon dual phase steel: Effects of micro structural features and experimental conditions, Materials Science and Engineering A, 458 (2007) 303-11, **1.347**

65. Asokan Pappu, Mohini Saxena, Shyam Asolekar, Solid wastes Generation in India and their recycling potential in building materials, Building and Environment, 42 (2007) 2311-20, **0.676**

National Patents granted and in Force

(As on 31 -3 -2007)

S No	Title	Inventers	Filing date	Application	Grant date	Patent no
1	A process for the extraction potash useful for fertiliser application from feldspar	S. S. Amritphale, R. K. Rawlley	06-08-92		29-12-2000	184097
2	An improved process for the preparation of alumina silicon carbide composites	C. B. Raju	30-09-93	1089/Del/93	28-03-2003	188036
3	A process of production and application of glazing material produced from foundry cupola slag	L. C. Mohan, R. K. Rawlley	29-03-96	1970/Del/98	15-03-2004	190600
4	An improved process for the preparation of Beta Silicon Carbide whiskers useful for making metal/ceramic/ glass matrix composites	C. B. Raju	20-07-95		30-11-2004	191807

5	A process for recovery of Zinc by oxidizing roasting of zinc ash	A. K. Majumdar, B. Kujur, J. Konar	29/11/1996	2631DEL1996	13/01/2006	193952
6	A non toxic composition useful for cleaning / de scaling of apertures / pipes and a process for cleaning /de scaling of apertures/pipes.	Amritphale, Navin Chandra	17/03/1997	0651DEL1997	20/01/2006	193953
7	A composition of red mud thermoplastic composite useful for environment friendly domestic & industrial applications	Navin Chand, S.A.R. Hashmi	13/05/97	1253DEL1997	10/02/2006	194596
8	An improved process for making value added products such as ceramic tiles	R. K. Rawlley	12/9/97	2594DEL1997	7/04/2006	194600
9	An improved process for the preparation of metal matrix composites	S. Das, R. Dasgupta, A. K. Jha, A.H. Yegneswaran B. K. Prasad	13/5/1997	1260DEL1997	23/6/2006	196946
10	A process for melt blending of incompatible non interacting polymers into homogenous mixture	N. Chand S.A.R. Hashmi	15/11/96	2507DEL 996	7/7/2006	195804

Foreign Patents granted and in Force

(As on 31 -3 -2007)

S. No.	Title	Author(s)	Patent No.	Country	Grant Date
1-3	A process for the manufacture of aluminum graphite particulate composites using unquoted graphite particle for automobile & engineering application	S. Das , P. K. Rohatgi, T. K. Dan, S. C. Arya, S. V. Prasad, A. K. Gupta, B. K. Prasad And A. K. Jha	2194799	UK USA AUS	14/03/90 07/08/90 19/09/90
4	A Low temperature process for making alkali free high surface area , amorphous, silicon precursor and its application making advanced ceramic materials such as silicon carbide, mullite	S. S. Amritphale Navin Chandra E. Kroke* R. Ralf* *German collaborators	19952337	Germany	8/3/07

PROJECTS INITIATED

S.No.	Project Name	Sponsoring agency	Project cost (Rs in lacs)
1	Development of cast in-situ copper based MMCs for Naval Applications and simulation of their microstructural features vis-a vis properties through FEM Analysis	Naval materials Research Laboratory, Ambernath	9.90
2	Development of cost and Energy efficient materials for feed &pressing worms and screws & cage bars of oil expellers	ICAR, New Delhi	13.53
3	Modifications of PPG/PEG Floor lining	Cresent Technologies Pvt Ltd, Bhopal	6.61
4	Beneficiation studies of low grade chromites ore	M/S Jindal Stainless Ltd	2.00
5	A novel cost effective process for making Nano materials useful for catalysis and application in making electrode	DST, New Delhi Young Scientist Scheme	9.42
6	REIA&Risk Assessment for Hydrocarbon Terminals at Abu Road, and Patri	Reliance Industries Ltd, Mumbai	9.00
7	Development of user friendly models for design and operation of jigs and heavy media cyclones for treatment of different coals	Min of Coal, GOI	34.22
8	Preparation of Turbo Rotor Wedge of 120 MW TG and establishing commercial availability	BHEL, Bhopal	9.40
9	Development of process of making PTFE lined thrust bearing pads for hydrogenerators	BHEL, Bhopal	9.90

PROJECTS INITIATED

S.No.	Project Name	Sponsoring agency	Project cost (Rs in lacs)
10	Field demonstration cum-training programme for use of fly ash in agriculture in farmers field at Sarni thermal power station of MPSEB	Fly Ash Utilisation Programme, TIFAC	15.00
11	Long term effect of Pond Ash (Angul)on soil fertility and crop yield at CPP,NALCO, Angul Phase VI	NALCO, Bhubaneswar	9.00
12	Rapid Environmental Impact Assessment for base metal mining at Ambaji,Rajasthan	GMDC Ahmdeabad	5.0
13	REIA and EMP for proposed lignite mine at Umarsar, Kutch	GMDC, Ahmdeabad	5.0
14	Demonstration of Fly ash, waste plastic, bitumen, and aggregate based composition for road	NTPC, Sidhi, MP	4.79
15	Rapid Assessment of Drinking Water Quality in the State of MP	UNICEF, Bhopal	19.25
16	REIA for Beneficiation Plant Modernisation and Fluorpar mining at Ambadungar	GMDC, Ahmdeabad	10.00
17	Grey water reuse system and Water Safety plan in Tribal Schools of Madhya Pradesh, India	UNICEF, Bhopal	2.95
18	Wear Performance Evaluation of Ni-Ti based shape memory alloy and composite under sliding and cavitation erosion conditions	BRNS, Mumbai	23.62

CSIR Network Projects

CSIR Network Projects

S.No	Project Name	Co-Ordinating Lab	Project Cost (Rs.Lakhs)
1	Development techniques and methodologies for exploration, assessment and management of groundwater in hard rock areas	NGRI, Hyderabad	103.680
2	Developing New Building Construction Materials and Technologies	CBRI, Roorkee	140.600
3	Industrial Waste Minimization	NEERI, Nagpur	101.00
4	Custom Tailored Special Materials	CGCRI, Kolkatta	82.270
5	Technology for Engineering Critical Assessment	NML, Jamshedpur	134.500
6	Capacity building for coastal mineral mining	CMRI, Dhanbad	37.90
7	Fugitive Emission monitoring and development of Emission factors for petroleum storage sectors	NEERI, Nagpur	56.000
8	Design Analysis and Health Assessment of special structures including bridges	SERC, Chennai	50.000
9	Mathematical modeling and Computer Simulation	C-MMACS, Bangalore	216.00
10	Developing Capabilities and Facilities for MEMS and Sensors	CEERI, Pilani	173.83
11	Developing Capabilities in Advanced Manufacturing Technologies	CMERI, Durgapur	13.80
12	Quality Enhancement of Coal for its effective utilization	CFRI, Dhanbad	97.000
13	Developing and sustaining High Science and Technology for Nationaal Aerospace Programmes	NAL, Bangalore	25.931(04-05)
14	Discovery, Development and Commercialization of new Bioactive and Traditional preparations	RDPD, CSIR	51.10(04-05)

Honors/Awards

National Award for Fly Ash Utilization

AMPRI, Bhopal has been awarded the National Award in recognition of the exemplary work done in the area of Fly Ash utilization. The award was given for the Research and Development work relating to the use of Fly Ash for Building Components, Agriculture & Value Added Products and was jointly conferred by Ministry of Power, Ministry of Environment and Forests and TIFAC, DST, GOI. The award was given during the International Congress on Fly Ash Utilization held on December 4 - 7, 2005 in New Delhi.

AMPRI, Bhopal has carried out extensive research on use of fly ash in developing cost effective alternative building materials (blocks, bricks, paint), fly ash filled polymers composites (wood substitute materials) and developed processes for vermi-compost and bulk utilization of fly ash in increasing the agricultural productivity. All these materials/processes have massive potential for the utilization in the livelihood development of rural sector and its sustainability.

Dr. N. Ramakrishnan, Director, AMPRI, Bhopal receiving the award

In addition, AMPRI, Bhopal has been actively involved in process development for value added materials through fly ash beneficiation, fly ash classification, Attrition milling of fly ash for reactivity improvement, cenosphere extraction and development of light weight materials with special properties and for immobilizing and recycling hazardous wastes in developing value added products using fly ash.

The laboratory is also actively involved in propagation of the above uses in the masses .

Dr. B. Chakradhar received the National Design Award in Environmental Engineering – 2005" from the Institution of Engineers(India) for his outstanding contribution in the field of Environmental Engineering Design.

Sh. Sanjeev Saxena, received the Dr. M. Ramaiah Prize for the Best Technical Paper by SERC, Chennai for his paper published in Engineering Structures.

Dr. A.K. Gupta received the National Metallurgists Day Award – 2005.

Dr. O.P. Modi, Dr. B.K. Prasad, Dr. A.K. Jha and Dr. A.H. Yegneswaran received the Bronze Medal for the paper published by MGMI.

Dr. Mohini Saxena, Mr.S.Murali, Dr. M. J. Nandan and Dr. N. Ramakrishnan presented with the Best Technical Paper Award for the paper titled " Sisal – Potential for Employment Generation and Rural Development " in the 3rd International Conference on Rural India at Hyderabad during November 10-12, 2005.

Dr. K. U. Bhaskar awarded Raman Research Fellowship For the Year 2007- 08.

Dr. A. K. Majumdar and Dr. J. P. Barnwal received the Gold Medal for the best paper- The Mining, Geological and Metallurgical Institute, India.

Deputations Abroad

DEPUTATIONS ABROAD

1. Dr. S. Das, Scientist was selected for the CII-AOTS training programme on "New Product Design for India : Design Management" and visited Japan to attend the same from 01-14 June, 2005 held at The Association for Overseas Technical Scholarship (AOTS), Kansai Kenshu Centre, Osaka, Japan.

2. Sh. Raghuvanshi Ram, Scientist was selected for MS degree on Dryland Management by United Nation University. During the study leave from March 30, 2005 to March 29, 2006, he worked at IRA, Tunisia and CAREERI, China apart from home country.

3. Dr. N. Ramakrishnan, Director visited krasnoyarsk, Russia under exchange visit under joint ILTP project of DST, NewDelhi with ICCT, krasnoyarsk, Russia during September 12-15,2005 and Germany during September 18-21, 2005 to attend 15th International Workshop on " Computational Mechanics of Materials" and present a paper on "FEM Characterization of Ductile Fracture Using Various Methods" at Max- Planck Institute, Dusseldorf, Germany.

4. Dr. N. Chandra, Scientist visited Krasnoyarsk, Russia under exchange visit under ILTP project between India and Russia during September 12-22, 2005.

5. Dr. R. N. Yadava, Scientist visited Australia during December 18 ,2005 to January, 2006 to visit University of Western Sydney on Community Base Water Resources Management; Australia Research and Development Institute, Adelaide and Center for Groundwater Studies, School of Chemistry, Physics and Interaction and meeting for possible collaborative project on Water Resources Management.

6. Dr. S. K. Sanghi, Sceintist visited France for 28 days from February 1, 2006 for carrying out research work under the IFCPAR funded project "New Detection Systems and Matrices for Microfluidics Separations"

7. Dr. Murari Prasad, Scientist visited Atlanta, USA for overseas training for the instrument ASAP-2020 Analyzer during November 14-17, 2006.

8. Dr. S. A. R. Hashmi, Sceintist visited Izmir, Turkey for attending the First Polymeric Composite Symposium and Exhibition during November 17-19, 2006.

9. Dr. R. N. Yadava, Scientist during his visit to Australia presented a paper entitled " Decision support system for sustainable watershed management: a case study in Raisen District of M.P., Central India" at the Joint Congress of 9th Australian Environment Isotope Conference and the 2nd Australian Hydrogeology Research conference during December 13-15,2006.

10. Dr. N. Ramakrishnan, Director visited USA during January 2-15, 2007 to deliver a keynote lecture on "Large Deformation FEM Analysis of Ductile Fracture" at International Conference on Computational & Experimantal Engineering &Sciences-2007(ICCES) and held discussions regarding ongoing project"Validated Microstructure Maps for Defining Hot Deformation Characteristics of Mg Alloys for Automotive Structural Applications" and future collaborations at General Motors, Detroit, USA.

11. Dr. R. K. Rawlley, Scientist visited Tehran, Iran as a resource person for the International Conference on Water Resources Management in Islamic Countries during February 19-20, 2007.

Infrastructure

CHARACTERIZATION

Servopulser UTM – 50 kN

- Phase Analysis
- Microstructure
- Composition
- Quantitative Analysis
- Mechanical Properties
- Tribology
- Electrochemical

X-Ray Diffractometer

Scanning Electron Microscope

Hydraulic Press
400 tonnes

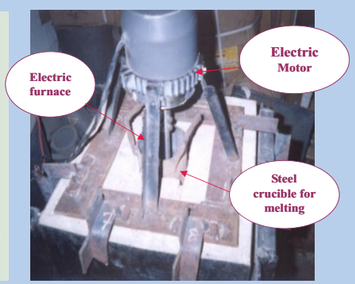
Secondary Ion Mass Spectrometer

Infrastructure

PROCESSING

Falcon Concentrator

- Metal Foam Processing
- Light Metal/ MMC Processing
- Natural Fibre composite Processing
- Mineral/Waste Processing



Foam Maker

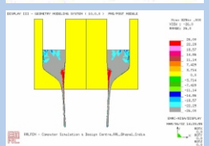
Knelson Concentrator

Fibre Composite Processing

Infrastructure

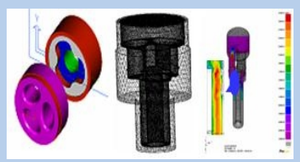
Computer Modeling, Simulation & Design

Servopulser UTM – 50 kN



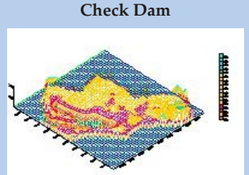
Hydrocyclone

CFD based Design



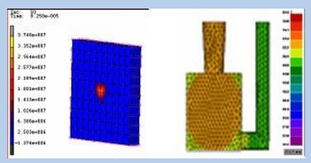
Porthole Die

Check Dam



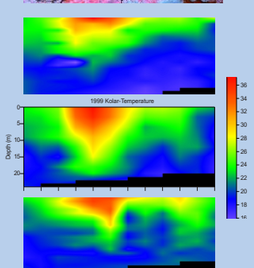
3D view of Wtershed

Watershed Management



Stress Distribution Solidification Behavior

Armour plate



Lake/Reservoir Management

विशिष्ट प्रसंग
Memorable Occasions

Visit of the Second Sub-Committee of the Parliamentary Committee on Official Language

The Second Sub-Committee of the Parliamentary Committee on Official Language visited Bhopal for inspection of the status of implementation of Official Language Policy of Govt. of India in some of the Central Government offices located here. In this regard, the performance of AMPRI, Bhopal was evaluated on June 30, 2005. The laboratory arranged a presentation and displayed exhibits on the related activites on this occasion.

Chairman of the Second Sub-Committee of the Parliamentary Committee on Official Language presenting Annual Programme to Dr. N. Ramakrishnan, Director, AMPRI

Seminar on Innovative Technologies *for* Rural Development

A two - day All India Seminar on Innovative Technologies for Rural Development was organized jointly by Institution of Engineers(India), M.P.State Centre and AMPRI, Bhopal during December 10-11, 2005.The seminar was inaugurated by Mrs. I.M. Chahal, IAS, Principal Secretary, Deptt. of Rural Industries, Govt. of M.P. Dr. S.C. Soni, Director, University Institute of Technology, Barkatullah University, Bhopal presided over the function. The technical deliberations took place during technical sessions on Use of Innovative Technologies for Rural Development, Watershed Development and Management technology, Development Initiatives for Rural Development and Innovation in Rural Technology Developments . The discussions during the seminar were centered around creating awareness about the importance of rural technologies for nation building and for improving the socio-economic condition of the rural masses.The seminar was attended by more than one hundred delegates drawn from a gamut of academic institutions, R&D organizations, defence establishments, universities and private and government organizations and industries engaged in providing developmental initiatives to the Indian rural scenarios. The deliberations and discussions of the Technical sessions were followed by Panel Discussions and Valedictory function. Dr. G. Singh, Vice Chancellor, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot was the Chief Guest at the Valedictory Function.

A view of the release of sovenir

Dr. R.A.Mashelkar, DG, CSIR visits

Padmabhushan, Dr. R. A. Mashelkar, FRS, Director General, Council of Scientific & Industrial Research and secretary, DSIR inaugurated Technology Enabling Centre, Computer Simulation and Design Center, Microfluidics & MEMS Center and Computational Fluid Dynamics Center at AMPRI, Bhopal on March 17, 2006.

Dr. Mashelkar also witnessed the progress made in various R&D activities of the institute in the areas of Wood Substitute, Building Materials, Sisal Composites, Materials from Industrial wastes, Automobile Sector, Modeling and Design, Cellular materials, Light materials, Tribo Materials, Environmental Modeling, CFD application in Minerals processing and Minerals Processing Design.He underlined the need to innovate cost effective new materials from natural resources.He appreciated the work done by the laboratory in the areas of Natural Fibre Composites, Al Foam, and Microfluidics and MEMS.

The Technology Enabling Centre is established at the laboratory to train the entrepreneurs, commercialise and Design and Development of machineries relating to the technology for making composites using industrial wastes, natural fibre and polymer.Dr. Mashelkar highlighted the Centre in his address as the representation of an ambition to look at the natural wealth of the country and addition of value to it.

The main functions of the Microfluidics and MEMS Centre of the laboratory are to develop and characterize the Micro Total Analytical System (-TAS) and their application for single molecule analysis and to develop miniaturized fuel cells for micro power generation. Dr Mashelkar underlined the MEMS Centre as the technologies of the tomorrow.

Dr. R.A. Mashelkar, DG, CSIR inaugrating the Technology Enabling Centre and Microfluidics and MEMS Centre

The Computational Fluid Dynamics Centre will work for Simulation, Design and development of different mineral processing unit operations, Simulation and design of environmental control technologies and water resource modeling.

The CFD application also includes consequence modeling of flammable material explosion and blast hazard analysis by applying PHAST software.

The Computer Simulation and Design Center is working for Simulation of film growth, Finite element simulation of tube extrusion and die design, Analysis of spring-back in sheet metal bending, Effect of friction in hot die forging, FEM characterization of Ductile Fracture, Casting simulation of porthole die extrusion, Application of Artificial Neural Network in Structural Shape Optimization and Simulation of nozzle pull out.

While addressing the staff of RRL, Dr. Mashelkar highlighted the progress made by the laboratory. He said that the lab has a happy smell in terms of attitude, passion and commitment. The physical income of the laboratory has gone up by three but the psychic income has gone up manifolds through the commitment and satisfaction of work being done by the scientists, he said. Highlighting the progress graph of CSIR during 1995-2005 he said that I am dangerously optimistic about the future of the country and it is not a hype, it is real hope. The issue is not about having resources, the issue is about having ideas, he said.
In the beginning, Dr. N.Ramakrishnan, Director, RRL presented a report on the activities of RRL.

Dr R.A. Mashelkar, DG, CSIR inaugrating the Computational Fluid Dynamics Centre and Computer simulation and Design center

Dr R.A. Mashelkar, DG, CSIR addressing the staff

AMPRI, Bhopal Silver Jubilee and CSIR Foundation Day

AMPRI, Bhopal celebrated its Silver Jubilee Year on September 26, 2006 alongwith the Foundation Day of CSIR
Dr. T. Ramasami, Secretary, Deptt. Of Science and Technology, New Delhi was the Chief Guest on the occasion. An exhibition on the R&D achievements of AMPRI, Bhopal was also inaugurated by the Chief Guest . Under the R&D achievements of the laboratory in Waste to wealth, light materials, Micro systems,Computer Simulation & Design, and Water Resources Management etc. various products such as Rural Climatizer and Instant Houses for Disaster Prone areas are worth mentioning.
Dr Mahesh Sharma, DG, MPCST and Scientific Advisor, Govt. of M.P. was the Guest of Honour on the occasion. In his address, Dr. Ramasami expressed his happiness on the silver jubilee of AMPRI. On highlighting the Indian R&D scenario, he said that the scientists should use their knowledge for the well being of the people. Research should be centred around the people of the world, he said.He said that our investment in R&D is not proportional to the abilities we have. In absence of the investment young people go to the areas where managing science is more attractive than generating science.
In his address Dr. Mahesh Sharma expressed his aspirations to work jointly with AMPRI in common areas of interest.
During his welcome address, Dr. N. Ramakrishnan, Director, AMPRI, Bhopal welcomed the chief guest and other dignitaries and underlined the achievements of CSIR and AMPRI, Bhopal.
On the occasion, **Dr. T. Ramasami inaugurated the Natural Fibre Composite Development Centre,** which will work in the following R & D areas Processing, extraction, looming, textile making relating to Sisal and other natural fibres such as banana, coir, pineapple and palm leaf, Sunhemp and jute.

Dr. T. Ramasami lighting the inaugural lamp

Dr. T. Ramasami inaugurating the Natural Fibre Composite Development Centre

Dr T. Ramasami addressing during the workshop

Composite development by using different types of polymers and natural fibres with and without waste fillers.
The chief guest also presented the in-house recognitions and awards.
On the occasion Dr. T. Ramasami also inaugurated a two-day workshop jointly organised by CLRI, Chennai and AMPRI, Bhopal on ''Mobile Flaying device for effective carcass Recovery''.

Visit of Russian Delegation

AMPRI, Bhopal and Institute of Chemistry and Chemical Technology, Krasnoyarsk, Russia are carrying out a joint project on the utilization of Industrial wastes such as Fly Ash, Zn-Pb Industry cake, Spent catalysts etc., for making value added products, supported by Department of Science and Technology , GOI and Russian Academy of Sciences , Russia under the Integrated Long Term Program (ILTP) of Cooperation between the two countries. Under this project investigations have been made to make ceramic products such as tiles, frit/glaze and ceramic pigments from the industrial wastes. Under exchange visit of Scientists under this project, Dr. N. Chandra, Prof. G.L.Pashkov, Dr. V. G. Samoylov, Dr. A. N. Anshits and Dr. Elena N. Voskrenseskaya visited in the recent years. These interactions have paved way in taking up new joint projects in different areas of mutual interest.

Meeting with th Russian delegation

Nayudamma Memorial Cricket and Sidhu Memorial Table-Tennis tournaments, March 16-18, 2007

Inauguration of the tournaments

Cricket team with Director, AMPRI

Nayudamma Memorial Cricket and Sidhu Memorial Table-Tennis tournaments were organized by AMPRI, Bhopal under the aegis of CSIR Sports Promotion Board, New Delhi. The tournaments were inaugurated on March 16, 2007 at AMPRI campus by Dr. N.R. Rajagpal, Former Head, HRDG, CSIR and Founder Secretary of CSIR Sports Promotion Board. These tournaments are organised in the memory of Dr. Y. Nayudamma and Dr. G.S.Sidhu, eminant scientists and Former Director Generals of CSIR.

While declaring the tournament formally open, Dr. N.R.Rajagpal underlined the spirit relating to sports. He also underlined the contributions of Dr. Nayudamma and Dr. Sidhu in the establishment of this Institute. He highlighted the importance of this tournament.

Dr. N. Ramakrishnan, Director, AMPRI underlining the importance of these events said that sports are not only for the body but it is also for the mind. It is the only thing which brings competitions but also makes friends.

Sh. Govind Ranade, Chairman Dispute Committee mentioned in his address that sportsman spirit and sportsmanship are the needs of the society today in all walks of life for releasing tension and to understand each other.

The teams were administered the oath of dedication to the sports by Dr. Govind Ranade. A Souvenir was released by the Chief Guest. Sh. Subhash Vithaldas, Chairman, Bhopal Zonal Council, CII and Director, Parmali Wallace Limited, Bhopal was the Chief Guest at the valedictory function. In all eight teams of about 130 players from CSIR and various S&T departments of the country participated in these matches. . Sh. Subhash Vithldas highlighted the role of sports especially for the scientists. He said that the results are only important upto the extent of medals etc. but the happiness one gets out of it is the real thing. He also complimented AMPRI, Bhopal for the successful organization of these tournaments. He gave away prizes to the winners.

Participation in Exhibitions

AMPRI, Bhopal participated in an exhibition organised during the International Congress on Fly Ash Utilization held during December 4-7, 2005.

AMPRI, Bhopal participated in an exhibition during the "Science Fiesta - 2005"organised by Regional Science Centre, Bhopal during December 9- 11, 2005.

AMPRI, Bhopal participated in an exhibition cum fair on "Rural Technologies" organised during February 18-22, 2006 at Amethi. The exhibition helped RRL to showcase its achievements in the area of Rural Development.

AMPRI, Bhopal participated in the " National Convention on S & T Communication for Growth and Empowerment " organized by Madhya Pradesh Council of Science and Technology (MPCST), Bhopal during 17-21 January 2007, and displayed its products and technologies. The R & D achievements of the institute on Rural development sector were well appreciated by the visitors. AMPRI was awarded the second best stall among all the participating organizations of the exhibition.

Students viewing the exhibits at AMPRI stall at 'Science Fiesta'

राजभाषा गतिविधियाँ

राजभाषा कार्यान्वयन की प्रगति

संस्थान में भारत सरकार की राजभाषा नीति के कार्यान्वयन को दृष्टि से इस अवधि में समय-समय पर कार्यशालाएं एवं प्रशिक्षण कार्यक्रम ओजित किए गए। अन्य प्रकाशन भी समायानुसार जारी हुए।

संसदीय राजभाषा समिति की दूसरी उपसमिति के सदस्य संस्थान के कार्य का अवलोकन करते हुए।

- 13-14 जून, 2005 को दो दिवसीय हिन्दी कार्यशाला सम्पन्न हुई। जिसमें सी.एम.आई.आर मुख्यालय, नई दिल्ली के वरिष्ठ हिन्दी अधिकारी डॉ. पूरन पाल अतिथि वक्ता के रूप में आमंत्रित थे। यह कार्यशाला वैज्ञानिक एवं तकनीकी और प्रशासनिक संवर्ग के अधिकारियों एवं कर्मचारियों हेतु दो सत्रों में आयोजित थी। कार्यशाला में डॉ. पूरन पाल ने प्रयोगशाला के स्टाफ सदस्यों को राजभाषा नियम, अधिनियम आदि की सरल व्याख्या की और राजभाषा के अधिकाधिक व्यावहारिक उपयोग पर उद्‌बोधन देकर अभ्यास करवाया।

- संसदीय राजभाषा समिति की दूसरी उपसमिति द्वारा 30 जून, 2006 को भारत सरकार की राजभाषा नीति के कार्यान्वयान की प्रगति का निरीक्षण किया गया। इस अवसर पर प्रयोगशाला द्वारा एक प्रस्तुतिकरण किया गया तथा राजभाषा संबंधी गतिविधियों के विषय में एक लघु- प्रदर्शनी प्रदर्शित की गयी। समिति के माननीय सदस्यों ने इस दिशा में प्रयोगशाला के प्रयासों की सराहना की।

- राजभाषा के वैज्ञानिक क्षेत्र में प्रगामी प्रयोग की दिशा में सामग्री विज्ञान पर वैज्ञानिक कार्यशालाओं की श्रृंखला प्रारंभ की गयी। इस श्रृंखला की पहली कार्यशाला 5 जुलाई, 2005 को आयोजित की गई। इसमें तीन वैज्ञानिक शोधपत्र प्रस्तुत किए गए।

- प्रयोगशाला में 7-14 सितम्बर तक हिन्दी सप्ताह का आयोजन किया गया। बरकतुल्लाह विश्वविद्यालय के तुलनात्मक भाषा विज्ञान एवं संस्कृति विभाग के प्रमुख डॉ. के.बी. पंडा कार्यक्रम के मुख्य अतिथि थे। इस अवसर पर स्टाफ एवं उनके परिजनों के लिए अनेक प्रतियोगिताएं आयोजित की गई। मुख्य अतिथि ने राजभाषा पत्रिका सोपान का विमोचन किया।

- भारत सरकार की राजभाषा नीति के कार्यान्वयन के एक चरण के रूप में प्रयोगशाला द्वारा 19-11 नवम्बर, 2005 की अवधि में एक दो- दिवसीय टेबल वर्कशॉप का आयोजन किया गया। सी.एस.आई.आर., नई दिल्ली के वरिष्ठ हिन्दी अधिकारी डॉ. पूरन पाल ने इस अवसर पर लगभग 50 अधिकारियों एवं कर्मचारियों को उनके कार्यक्षेत्र में हिन्दी के अधिकाधिक प्रयोग की संभावनाओं के संबंध में मागदर्शन दिया।

- 22 दिसम्बर, 2005 को प्रयोगशाला में राजभाषा के माध्यम से एक वैज्ञानिक कार्यशाला का आयोजन किया गया। श्रृंखला की इस दूसरी कार्यशाल में वैज्ञानिकों ने तीन शोधपत्र प्रस्तुत किए।

- 17 जनवरी, 2006 को प्रयोगशाला स्टाफ हेतु कम्प्यूटर में हिन्दी अनुप्रयोग विषयक कार्यशाला-सह प्रशिक्षण कार्यक्रम का आयोजन स्कोप कॉलेज, भोपाल में किया गया।

- प्रयोगशाला के लिए द्विभाषी दूरभाष निर्देशिका का प्रकाशन किया गया।

- प्रयोगशाला में प्रयुक्त हो रहे प्रपत्रों के संशोधित रूप का द्विभाषीकरण किया गया।

- प्रयोगशाला की वेबसाइट को समग्रत: द्विभाषी रूप में तैयार किया गया। इस तरह यह सी.एस.आई.आर. की अग्रणी प्रयोगशालाओं में आ गई, जिसकी वेबसाइट समग्रत: द्विभाषी है।

- राजभाषा पत्रिका सोपान का प्रकाशन किया गया।

मुख्य अतिथि श्री भगवत रावत सोपान का विमोचन करते हुए

- 25 अगस्त, 2006 को राजभाषा माध्यम से एक दिवसीय वैज्ञानिक कार्यशाला का आयोजन किया गया। प्रो.जे.के. श्रीवास्तव, शासकीय अभियांत्रिकी महाविद्यालय, उज्जैन कार्यक्रम में मुख्य अतिथि थे। इस कार्यशाला में चार तकनीकी शोधपत्र प्रस्तुत किए गए।

- संस्थान में 07-14 सितम्बर, 2006 की अविध में हिन्दी सप्ताह का आयोजन किया गया। वरिष्ठ साहित्यकार एवं आलोचक श्री भगवत रावत मुख्य कार्यक्रम में मुख्य अतिथि थे।

Sisal Fiber Technologies

AMPRI has been extensively working in the area of natural fiber based materials such as wood substitutes, asbestos, natural fiber composites etc. Among the natural fibers it is proposed to focus on Sisal Fibers since this xerophyte plant grows abundantly in our country and the fibers have excellent physical and mechanical properties. Technology development in this direction would greatly enhance the rural employment potential and the time is ripe for to consolidate the earlier experience and plunge aggressively into giving life to the already established technologies.

प्रगत पदार्थ तथा प्रक्रम अनुसंधान संस्थान
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