Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur

Autonomous Body Under Ministry of Mines

NABL Accreditation Conferred

R&D NEWSLETTER शोध पत्रिका

30 Years of Commendable Service to the Aluminium Industry

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VISION
To be renowned nationally and globally as primary research hub for all aluminium products and processing

MISSION
To undertake innovative research projects for providing complete technological solutions to meet the challenges for sustainability of aluminium industry

OBJECTIVES
To assimilate and adapt the technologies suitable for raw materials available in India for the production of alumina and aluminium and to develop indigenous know-how and basic engineering packages for future alumina and aluminium plants to be set up in the country.

To undertake research programs especially in the area of reduction in material and energy consumption and to provide analytical services to the industries.

To set up and operate data banks in the areas of bauxite, alumina and aluminium production for the benefit of the industries.

To provide training to the personnel employed in the Indian aluminium industry through organisation of workshops, seminars and group training programs.

To provide technological assistance to the secondary aluminium industry especially in the areas of downstream processes and wastes recycling.
Dear Readers,

At the outset, on behalf of entire staff of Centre I wish you all a very happy and prosperous new year 2019. On the international scene, global aluminium production grew at its slowest pace in the decade in 2018 and most of that was in the first half of the year. According to the International Aluminium Institute (IAI), total output was at 64.34 million tones which is up by just 1.5 percent in 2017. It was the weakest production performance since 2009, when the industry was battered by the global financial crisis, a collapse in prices and multiple smelter closures. Even China, the world’s dominant producer, ran out of expansion steam last year with growth of 1.6 percent, while the rest of the world managed just 1.4 percent. Also, the prices for aluminium have largely trended downward in 2018, interrupted only by a sharp and short-lived upturn in the second quarter when US sanctions on Russian aluminium drove prices up. Moreover, China’s slowing growth, exacerbated by the tit-for-tat trade war with the US, has weakened demand for the metal. The resulting supply/demand dynamics have pushed prices down. It appears that in the coming 5 years, aluminium consumption in India will be doubled from existing level of 3.6 million ton to 7.2 million ton. Unless we focus on aluminium downstream unit, India will be importing around 5 billion-dollar worth downstream aluminium products. Indian Aluminium Industry is at the high end of cost curve for production and the industry need to sustain and increase its margin by producing value added and high-end downstream products. We see aluminium demand growth being extremely healthy and the year 2018 was another eventful year for JNARDDC in terms of visibility and R&D activities. The Centre was instrumental in compiling strategy paper on Resource Efficiency in aluminium sector. The state of art aluminium extrusion press is installed and will be commissioned shortly which will surely prove boon to the aluminium extrusion industry, researchers, defense and country as a whole. The Centre has initiated the process of formulating Standards for Aluminium Scrap under aegis of Bureau of Indian Standard (BIS). I invite & welcome you all to JNARDDC with a request to get associated with the Centre for extracting the maximum R&D benefits out of facilities & expertise available with us.

Jai Hind
As a benchmark, Laboratory quality is demonstrated by compliance to ISO standards which is enabled in India through NABL accreditation. It gives global equivalence, helps in better control of laboratory operations, improves staff and customers confidence and satisfaction. It was proud moment for JNARDDC to be granted the accreditation (9T-4561) by National Accreditation Board of Testing and Calibration Laboratories (NABL, New Delhi). This will lead to further expansion of the testing and consultancy services of JNARDDC. The management applauded the effort of all members and staff involved in achieving the above feat.
Team of Scientists led by Director JNARDDC visited Shraddha Associates, Ahmedabad (pioneer in the field of proppant production and major supplier to ONGC and others) on August 01, 2018. Extensive discussions were held for identifying suitable mineral product mix for the production of proppant so that desired strength properties are achieved. Crushing strength determination equipment and tests were witnessed. Possibilities of collaborative activities were also discussed.

One Day Capacity Building Programme on “Geo-informatics Technology” was organized by Maharashtra Remote Sensing Application Centre (MRSAC) on August 08, 2018 at JNARDDC, Nagpur to impart necessary skill sets to the officials of JNARDDC and GSI for utilising the advance geospatial technology. Dr Subrata Das, Director MRSAC and his team enlightened participants on overview of the Remote Sensing Technology, its relevance and utilization in ongoing project on “Large scale digital database creation of bauxite and laterite deposits of Maharashtra State using geo-informatics technology” being jointly executed with GSI. Team also provided hands on training on Project Data/ArcGIS Softwares. The programme was grand success and knowledge shared will be very useful in ongoing as well as future projects.
MRAI at JNARDDC

MRAI (Material Recycling Association of India) delegation led by Dr Kishore Purohit visited JNARDDC on 10th September, 2018 to discuss modalities for execution of joint project proposal “Techno-economic Survey of Aluminium Scrap Recycling in India” which is under consideration for award with Ministry of Mines, Govt of India. During the meeting detailed discussions were held and strategy was devised to conduct the survey in most professional and exhaustive manner and ensure that most of the micro, small and medium enterprises engaged in aluminium scrap recycling, though fall in unorganised sector, are covered. Outcome of the survey will be very crucial since based on it Government will be formulating policies for the sector.

Visit to HINDALCO industries, Hirakud

High level delegation of Scientists and consultants led by Dr Anupam Agnihotri, Director, JNARDDC visited Hirakud Plant of HINDALCO Industries on 25-26 October 2018 to discuss in depth proposal to set up Spent Pot Lining (SPL) Treatment plant submitted by JNARDDC. All doubts and queries raised were addressed and capacity of the plant was freeze to 5 TPD having kiln equipped with induction heating. JNARDDC will take into consideration every aspect of safety, operational ease and environment related issues discussed during the visit and will submit revised suitable proposal for setting up of SPL Treatment Plant which will meet all requirements of HINDALCO, Industries.

JNARDDC to extend helping hand to Sierra Leone based company

Senior officials of Anant Resources Limited, Sierra Leone visited Jawaharlal Nehru Aluminium Research Development & Design Centre in September 2018 and held intense interaction with concerned Scientists and witnessed the analytical facilities available at Centre for finalizing the arrangements to utilize their services to thoroughly characterize bauxite samples drawn from pits. Drilling on Plateau is expected to start subsequently, which will help in proving the Reserve and Resources of the Bauxite deposit and to make the JORC.
Discussion with GSI and PWC

Team from Geological Survey of India (GSI), Kolkata and Price Waterhouse Coppers Pvt Ltd (PWC) visited Centre on October 25, 2018 to explore the possible participation/contribution of JNARDDC in National Geoscientific Data Repository (NGDR) project, being executed by GSI with PWC as consultant, aimed at making available geological, geochemical, geophysical, and mineral exploration data in public domain on a digital geospatial platform. NGDR programme is aimed at increasing contribution of mining sector to GDP and reduced mineral imports. Focussed discussions were held on extensive work done by JNARDDC in establishing Bauxite and Laterite data banks for different regions in the country and possible information which can be brought in public domain was identified.

Release of Report on Status of Bauxite

Symposium on “Technology Roadmapping – From Insights to Actions” was organized by Technology Information Forecasting Assessment Council (TIFAC), New Delhi on October 31, 2018 during which five prestigious reports on electric mobility, biomass potential, sea weeds, castor and Bauxite were released. Bauxite (prime raw material with potential from the perspective of energy, climate change, value addition and exports etc) was chosen by TIFAC and with major support from JNARDDC prepared exhaustive report on “Bauxite–Status, Challenges, Opportunities & Road Ahead” which was released during the symposium which was graced with the presence of eminent personalities like Dr Anil Kakodkar, Chairman TIFAC, Dr VK Saraswat, Member, NITI Aayog, Prof Ashutosh Sharma, Secretary DST and Dr A R Sihag, Secretary DHI etc.

Strategy Paper on Resource Efficiency (RE) for NITI Aayog

NITI AAYOG has entrusted JNARDDC with preparation of strategy paper on “Strategy on Resource Efficiency in Aluminium Industry” highlighting the key elements. In accordance with commitment of the Government of India to SDG vision 2030, NITI Aayog along with EU delegation to India released a Strategy on resource efficiency in November 2017. The strategy has provided detailed recommendations to improve RE at each stage of the production process and along the entire life cycle of a product. In accordance with this strategy action plan, it was inter alia decided to formulate a strategy on RE in aluminium Sector.
Bureau of Indian Standard (BIS) Meeting at JNARDDC

Bureau of Indian Standard (BIS) has formed Panel headed by JNARDDC with representatives from AAI, primary producers and secondary processors, NTH and MRAI etc with a task to formulate Standards for Aluminium Scrap. Committee meetings were held twice so far (1st Nov 2018 & 18th Dec 2018) during which it was agreed that envisaged standards will define specifications for aluminium and aluminium alloy scrap to be used for wrought product applications (electrical, extrusion, rolled product and utensils - covering both, food and non-food applications) as well as casting product applications (auto and other castings) while keeping in mind that scrap should be processed considering the integrity of the environment, quality of human health, appropriate processing of hazardous waste with scrap and quality of end applications. The committee decided to gather and study in depth information on practices followed around the globe before finalising the standards.

CUMI at JNARDDC

Dr Sivakumar, General Manager (QA, PC & Systems) from Carborundum Universal Limited (CUMI) visited JNARDDC on 19 December 2018. During his visit he had close look at the facilities of the Centre and had detailed discussions with team of Scientists. Dr Kumar has sought help from JNARDDC for devising process route for feed bauxite (for their Bauxite Calcination Plant in Okha, Gujarat) which is aimed at attaining alumina content of 85% post calcination for subsequent trouble-free electrofusion. JNARDDC agreed to submit the proposal shortly.

Delegation from Shri Bajrang Power & Ispat

Mr S K Acharya (VP-Mines) and Mr Anup Mathew (Head R & D) of Shri Bajrang Power and Ispat Ltd., Raipur (Member of famous Goel group of companies well known for its TMT bars) visited JNARDDC to have a look at the facilities of the Centre and seek advice and assistance of JNARDDC in their diversification plan to set up bauxite calcinations plant in Chhattisgarh region where Goel group holds bauxite mining lease. Detailed discussions were held and guidelines were given to draw representative samples from mine pit which will be extensively characterized by JNARDDC and based on outcome of the same further course of action will be decided.
Aluminium Network Meet

Ministry of Mines in association with JNARDDC organized one day Aluminium Network Meet (ANM) on October 12, 2018 to showcase Centre’s achievements and for conducting a meaningful interaction with the stake holders. Dr K Rajeswara Rao, IAS, Additional Secretary, Ministry of Mines and Dr T K Chand, CMD NALCO presided the inauguration program. Shri Alok Chandra, Director, Ministry of Mines chaired the sessions with Dr Anupam Agnihotri. The Meet received overwhelming response with widespread participation (about 70 participants) from various organisations which included all primary aluminium producers, secondary aluminium processors, bauxite mine owners, aluminium related industries, MRAI, FIMI FICCI, BEE, CPCB, Consultants etc.

JNARDDC Brochure was released at the hands of the dignitaries. During the meet MOUs were signed with various organizations.

MoU with M/s Sterling Educational Systems, Nagpur for the supply of complete package to prospective investors desirous of setting up of SPL treatment plants ranging from 5 TPD to 50 TPD capacity.

IMERYS India signed MoU with JNARDDC to utilize its world class analytical facilities and expert services for thorough characterization of variety of minerals intended to be mined and processed by IMERYS Group which is a world leader in mineral-based specialties for industry;

Anant Resources Limited, Sierra Leone having exploration license for 163.08 Km² (40280.76 Acres) area containing minerals and multi mineral deposits which include bauxite, gold, hematite, columbite and Tantalite has signed MoU with JNARDDC to utilize the services of JNARDDC to thoroughly characterize bauxite and subsequently other mineral ores.

Material Recycling Association of India signed MoU with JNARDDC to promote activities such as public awareness campaigns, research and development activities, holding seminars/workshops, help local industries in educating adapting suitable available technologies and practices around the globe for aluminium and aluminium industry waste management and recycling.

Meet was a great success and will surely help JNARDDC in opening new vistas and taking R & D work being pursued by Centre to the next higher level.
Prof Dilip Peshwe and Dr Kavita Pande form Department of Metallurgical and Materials Engineering, VNIT, Nagpur visited the Centre along with team of students to acquaint themselves with the activities of the Centre in the area of Geopolymers from Industrial Waste. Delegation from VNIT was highly impressed by the phenomenal work being done by JNARDDC in waste utilisation. During the discussions Prof Peshwe requested for the guidance from JNARDDC Scientists for their UG and PG students who are working on producing basic geopolymer products. JNARDDC has readily agreed to provide the all necessary guidance from time to time for their ongoing activity, nano processing of raw materials and producing value added products etc.

VIBHA STUDENT FORUM established by Vigyan Bharati in various schools to help develop the scientific temperament in the student right from their childhood had organised “Meet the Scientist” programme at Hindu Mulinchi Shala, Mahal, Nagpur on 8th September 2018. During this programme, Mr R N Chouhan, Principal Scientist, JNARDDC delivered the interactive talk on aluminium extraction process and applications. Talk was enthralling and will certainly arouse awareness amongst youngsters about usage of aluminium in day to day life.
Studies on Trace Liquor Impurities, its Behaviour and Control in Bayer’s Process with respect to Reduction in Product Hydrate (Joint Project with NALCO)

Sponsor: NALCO, Bhubaneshwar  
Principal Investigator: Dr Upendra Singh  
Co-Investigators: Dr S P Puttewar, M J Chaddha, K Janbandhu

This joint project with NALCO was aimed at conducting studies for reduction/control of trace impurities from Bayer’s liquor to improve the quality of the product. The samples were collected from different unit operations at NALCO Alumina Refinery, Damanjodi, Odisha. The complete profiles of impurities were studied from feed bauxite to final product to assess the behaviour and movement in different unit operations and its control at refinery. The equilibrium solubility was studied with available salts in the market to study the saturation concentration of trace impurities in plant liquor as well as synthetic liquor. Digestion of bauxite was also carried out using plant liquor and pure caustic to study the dissolution behaviour and movement of impurities during process. Lime causticization was tried in washer overflow 3rd stage based on soda concentration and C/S ratio which showed significant reduction in impurities.

The outcome of this study reveals that the impurities can be reduced by chemical routes i.e. addition of some reagents such as sodium diethyl di thiocarbamate tri hydrate, sodium sulphide, sodium dodecyl sulphate and extra in liquor. The trace impurities can also be reduced in washer overflow 3rd stage by increasing the dose of lime.

Development of Instrument for Instantaneous Onsite Measurement of Bath Parameters (Joint Project with HINDALCO, Hirakud)

Sponsor: HINDALCO, Hirakud  
Principal Investigator: Vimal Kishor Jha  
Co-Investigators: Rajendra J Sharma, Manoj T Nimje

JNARDDC has successfully designed, developed, delivered and demonstrated the robust and easy to operate equipment suitable for instantaneous measurement of bath parameters (operating temperature, liquidus temperature, superheat, aluminium fluoride, free alumina and bath ratio) to HINDALCO Industries for their Hirakud Smelter Plant. The equipment has been tailor made to suit the plant conditions prevailing in Hirakud Smelter and incorporates unique features like Wi-Fi enabled Data Acquisition System and Electromagnetic Compatible Tablet for ease of operation. Dedicated team of JNARDDC associated with execution of this project deserves special accolade for the significant feat achieved.
Characterization & Technical Assessment of Hazardous/Other Wastes from Process Industry (Joint Project with High Tech Metaflux, Raipur)

**Sponsor:** High-Tech Metaflux, Raipur  
**Principal Investigator:** Dr Upendra Singh

JNARDDC recently concluded this project. Products (fluxes such as Metric Super, Slag Treat Powder, Teeming Powder, Ladle Covering Compound, Synthetic Slag, Carbon Additives and Tundish Powder/Casting Powder) manufactured by Hi-Tech Fluxes were collected from its premises. The synthetic samples were prepared from the waste/process rejects (such as dross, waste carbon dust, shot blast dust & carbon bath/skimmed bath and other non-hazardous raw materials like lime, soda, rice husk, mill scale, graphite powder etc). Raw materials, manufactured products as well as synthetically prepared product samples were extensively characterised. Mass balance studies carried out with raw materials and manufactured product as well as raw materials with synthetically produced product samples indicated close resemblance with calculated ones.

Toxicity Characteristics Leaching Process (TCLP) was carried out for raw materials and finished products for the leachable hazardous level chemical entity. Values obtained for TCLP test for finished products were found to be matching with those obtained for raw materials.

Effect of Modified Seed Properties in Precipitation of Aluminium Hydroxide from Bayer Liquor

**Sponsor:** S&T, Ministry of Mines, Govt of India  
**Principal Investigator:** Dr (Mrs) Suchita B Rai  
**Co-Investigators:** M T Nimje, M J Chaddha, R J Sharma

The successful completion of this project whose main objective was to evaluate output from precipitation process in term of liquor productivity by altering or modifying seed surface properties has led to development of new products and processes. Established precipitation process route parameters and successfully produced  
- fine hydrate (10-12 μm)  
- high surface area alumina hydrate (BET SA 150- 250 m2/g)  
- boehmite product hydrate  

Also produced alumina from boehmite hydrate (having properties close to smelter grade alumina) and coarse & fine high surface area gamma alumina.

Large Scale Digital Database Creation of Bauxite and Laterite Deposits of Maharashtra State using Geo-informatics Technology (Joint Project with MRSAC & GSI)

JNARDDC has successfully completed this project using GIS and remote sensing technology which has led to creation of exhaustive and comprehensive digital database related to geology, geomorphology & technological characteristics of Bauxite and Laterite deposits of Maharashtra in geospatial domain. The Master Plans & Resource Plan Atlas prepared provide, at a glance scenario of deposits, data on geology, geomorphology, LULC, soil, slope, extensive information on cadastral, GIS, technological data, etc. Prospective entrepreneurs, with limited efforts, can get plethora of information related to environment, economic, accessibility, habitation, available manpower, etc which will be very useful while mining. The app based utility - GeoPDF files derived is another unique deliverable of this project.

JNARDDC is fully committed to take challenge of creating similar digital databases for bauxite and laterite deposits in rest of the states in the country in coming years.
Synergistic Utilization of Aluminium Industrial Wastes for Development of Geopolymeric Building Materials (Joint Project with M/S Swarnalata Holdings, Raipur)

Sponsor: S&T, Ministry of Mines, Govt of India and M/s Swarnalata Holdings
Industrial Partner: Saket Jain M/s Swarnalata Holdings, Raipur
Principal Investigator: Dr Mohammed Najar P A
Co-Investigators: M J Chaddha, Dr P G Bhukte, M T Nimje, Dr S P Puttewar

In the latest studies, components in mix designs studied earlier were altered to verify synergy among the components. The corresponding impact on water absorption, efflorescence and crushing strength of geopolymerized products has been studied. It is observed that the input of lime sludge in geopolymer mix designs deteriorate physical properties such as enhanced water absorption (from 15 to above 20), efflorescence (slight to moderate) and reduced crushing strength (12 to 8 MPa). Paver blocks (1 x 1 sq foot size with ~ 40 MPa crushing strength generated with mix fly ash and Granulated Blast Furnace Slag in 40:60 w/w) were laid on footpath and flooring of car parking to study the impact of weathering and durability. The cost of geopolymer paver block is calculated as Rs. 18 which is cheaper than traditionally used cement-based paver blocks. The project activities are nearing completion stage and report preparation is in progress.

Developing Downstream Applications of Strip Cast Aluminium Alloys AA8011 and AA3004 (Joint Project with NALCO & VNIT, Nagpur)

Sponsor: S&T, Ministry of Mines, Govt of India
Principal Investigator: R N Chouhan
Co-Investigator: P Mahendiran

Strip cast & cold rolled samples of AA8011 alloy collected from NALCO were tested for their forming characteristics using Deep Drawing/Cupping Test equipment under varying clamping force and cupping speed. Samples of cast strips were rolled at IISc, Bengaluru and are being extensively characterised (mechanical, texture, forming). Set up anodisation laboratory where anodizing characteristics of the thermo mechanically treated sheets will be optimised shortly.

Status Report on Work Carried Out Nationally and Internationally on Red Mud to Benchmark Future Investigation in the Country

Sponsor: S&T Division, Ministry of Mines, Govt of India
Principal Investigator: Dr (Mrs) Suchita Rai
Co-Investigator: M J Chaddha

The objective of the project is to prepare a status report on work carried out nationally and internationally on red mud. Based on the data collected, detailed report covering various aspects of red mud such as generation, characteristics, disposal & storage practices, utilization (in construction, infrastructure, vegetation, paints and pigments etc) and recovery of valuables etc is under preparation.
Utilization and Development of Process for Recovery of Strategic Rare-Earths from Industrial Waste–Bauxite Residue at Lab Scale (Joint Project with HINDALCO and IREL)

Sponsor: DST, New Delhi
Principal Investigator: Dr Upendra Singh
Co–Investigators: Dr S P Puttewar, Dr Priyanka Nayar

The physical beneficiation was attempted to concentrate the REE grade and reduce the iron content present in bauxite residue prior to leaching process. Hydrocyclone test was carried out to study the effect of the variables namely pressure, apex diameter and diameter of vortex finder. It was observed that there is significant enhancement of REE content in overflow than underflow with varied conditions. Optimum operating conditions (Pressure 20 psi, Apex dia – 6.4 mm, and Vortex dia – 8 mm) established showed good REE grade–recovery. Multi-gravity Separation technique was also tried which indicated enrichment of REE content (Sc – 55.0 mg/kg, La – 77.6 mg/kg & Ce – 129.5 mg/kg) in tailing fraction. More trials are underway for achieving maximum enrichment of REEs in lighter fraction. Bench scale leach tests were carried out using both the raw and upgraded feed which confirmed that reduction of iron levels prior to leaching has positive effect on rare earth leaching efficiency. More trials are underway for optimising parameters for maximum leaching efficiency. Sieving, hydrocyclone and multi-gravity separation appear to be viable options for enrichment of REE’s in bauxite residue.

Fabrication of Advanced Ceramic Nano–Coatings for Automotive Applications (Joint Project with Christ University, Bangalore)

Sponsor: S&T Division, Ministry of Mines, Govt of India
Principal Investigator: Dr Priyanka Nayar
Co–Investigators: Dr S P Puttewar, Dr Mohamed Najar P A

Installed Spin Coating Machine procured for deposition of alumina coatings. Optimization of process parameters (rpm, deposition time, acceleration) for deposition is in progress. Another technique of deposition (plasma spray method) is being studied by project partner (Christ university, Bangalore).

Nano Processing of Industrial Rejects for Use as Additives in Mix-Designs for Improved Pozzolanic Reaction Efficiency (Joint Project with VNIT, Nagpur)

Sponsor: S&T Division, Ministry of Mines, Govt of India
Principal Investigator: Dr Priyanka Nayar
Principal Co–Investigator: Dr Mohamed Najar P A
Co–Investigators: M J Chaddha, Dr S P Puttewar

Procured and installed High Energy planetary ball mill (Maximum power of 2.2 kW and higher acceleration of 64g) for milling of individual as well as mixed compositions of different aluminium and steel industrial wastes. This mill not only grinds material to nano level but is extremely fast compared to conventional ball mill.

Based on the results conducted and provided by VNIT (conductivity tests for evaluating pozzolanic property of grounded materials) some mixed compositions are identified for further tests which will fully assure the pozzolanic nature of the same.
Estimation of Morphodynamicity and Its Remedial Action Using Red-Mud Based Concrete at Coastal Zone of Eastern Odisha (Joint Project with IIT, Bhubaneswar)

Sponsor: S&T Division, Ministry of Mines, Govt of India
Principal Investigator: Mukesh J Chaddha
Principal Co-Investigator: Dr Mohamed Najar P A
Co-Investigators: Manoj T Nimje, Dr S P Puttewar

Developed red mud based fired stabilized hard blocks prepared using 70 % red mud, 25 % high siliceous plastic clay and 5 % Talc with compressive strength comparable to class 20.0 of fired clay bricks. Also developed geopolymer blocks which were prepared by IIT, Bhubaneswar using 35 % red mud, 65 % fly ash (keeping $\text{Na}_2\text{SiO}_3/\text{NaOH}$ ratio of 1.5 and alkaline solution to binder solids ratio of 0.5) with strength of about 18 N/mm². The blocks prepared will be placed along Kendraparha coastal area of Odisha which is facing severe erosion problems. In consultation with relevant authorities in Odisha, site (Dudhia River Muhana mouth, near Puri) was identified for flying UAV Drone jointly with Maharashtra Remote Sensing Application Centre, Nagpur (MRSAC). The Timeline data of 10 years of the site starting from 2006, indicates gradual change of course of Muhana river and formation of bund in 2015. The orthophoto pictures captured from UAV drone has helped in identifying site where the blocks will be placed in the second phase of the project to study the erosion patterns.

Development of Ceramic Proppant from Low Grade Materials (Partially Lateritised Khondalite –PLK, Fly Ash, etc.) (Phase-II –Scale up Studies)

Sponsor: NALCO, Bhubaneswar, Odisha
Principal Investigator: Dr Pravin G Bhukte
Co-Investigators: Dr S P Puttewar, M J Chaddha

Objective of the project is to set scale up facility for the production of proppants from Partially Lateritised Khondalite (PLK), fly ash, additives etc. and optimization at bench scale (10-15 kg/day processing). Established procedure for producing high strength ceramic proppant (on laboratory scale) from PLK by using various additives such as sillimanite, pyrophyllite etc.
Development of Inline Automated Anode Butt Monitoring System to Measure Anode Butt Parameters (Joint Project with NALCO)

Sponsor: NALCO, Bhubaneshwar, Odisha
Principal Investigator: Vimal Kishor Jha
Co-Investigator: Rajendra J Sharma

Objective of the project is to develop automated anode butt inspection system which will provide vital information and various defects in the anode butt, which will be useful in optimising anode fabrication process and improved pot control.

Visited Angul Smelter for selecting the suitable place for installation of cameras and other hardware parts. Sensors, Cameras and relevant hardware are being studied. Synchronization of ‘n’ number of cameras on the basis of the output of the sensor/camera and development of image analysis software is underway.

Utilization of PLK (Partially Laterised Khondalite) as a Potential and Value-Added Filler Material with Specific Reference to White Ceramics and Pigments (Joint Project with C V Raman College of Engineering & NALCO)

Sponsor: NALCO, Bhubaneshwar, Odisha
Principal Investigator: Dr Mohamed Najar P A
Co-Investigators: Dr P G Bhukte, M J Chaddha

Iron oxide (Fe₂O₃) content in Partially Laterite Khondalite (PLK) was successfully brought down substantially. Physical methods of separation viz. Wet High Intensity Magnetic Separator (WHIMS), Spiral Concentration and Hydrocyclone etc. were attempted but were not found effective in reducing iron oxide content to the targeted range of 1-2%. Subsequent attempts to produce PLK (with low Fe₂O₃ and high Al₂O₃ & SiO₂) in bulk quantity using acid leaching route are in progress. Once successful, trials to validate the use of PLK as binder for ceramics and pigments will be attempted.

Development of a Wi-Fi Enabled Sensor Arrangement for Online Measurement of Anode Current Distribution of Aluminium Electrolysis Cell (Joint Project with NALCO)

Sponsor: NALCO, Bhubaneshwar, Odisha
Principal Investigator: Rajendra J Sharma
Co-Investigator: Vimal Kishor Jha

Objective of the project is to develop a Wi-Fi enabled sensor arrangement for online measurement of anode current distribution of aluminium electrolysis cell which will result in reducing cell instabilities and improved pot control & efficiency. Finalised the direct contact type of sensor and acquisition system and initiated the process for procuring the same. Plant will be visited shortly to identify suitable location for mounting the sensor and subsequent trials.
To Study the Fire Retardancy of Nano-ATH in Polymers

**Sponsor:** S&T Division, Ministry of Mines, Govt of India  
**Principal Investigator:** Dr (Mrs) Suchita Rai  
**Co-Investigators:** M J Chaddha, M T Nimje, R J Sharma, K J Kulkarni

The objectives of the project are to investigate the effect of nano-ATH as fire retardant filler in polymers, to examine the mechanical and flame-retardant properties of polymer/ATH composites obtained using ATH fillers with different particle size and new process and product development using aluminium trihydroxide and polymer matrix.

Recovery of Smelter Grade Alumina and Silica from Coal Fly Ash

**Sponsor:** S&T Division, Ministry of Mines, Govt of India  
**Principal Investigator:** M T Nimje  
**Co-Investigators:** Dr (Mrs) Suchita Rai, R J Sharma, V K Jha

Aim of the project recently cleared by PERC, MoM is to develop bench scale process for the extraction of pure silica and aluminium fluoride from abundantly available Coal Fly Ash (CFA)-solid waste being generated in thermal power plants around the country which typically contains 27-31% alumina ($\text{Al}_2\text{O}_3$), 56-60% silica ($\text{SiO}_2$) and 9-13% oxides of elements (Ca, Mg, Na, Fe, Ti etc.). CFA will be treated with mineral acid for extracting pure silica (which is used in structural materials, microelectronics, food & pharmaceutical) and aluminium fluoride (which is heavily consumed by primary aluminium industries ~15 to 20 kg/t Al). Results from preliminary inhouse studies prompted us to take up this challenging R & D programme, which has potential to address not only national but internationally burning issue and whose success will be big boost in improving global environment.

Techno-economic Survey of Aluminium Scrap Recycling in India (Joint project with MRAI)

**Sponsor:** S&T Division, Ministry of Mines, Govt of India  
**Principal Investigator:** R N Chouhan  
**Co-Investigators:** P Dungore

Compared with the production of primary aluminium, recycling of aluminium products needs only 5% of the energy and emits only 5% of the greenhouse gases. Recycling is a major facet of continued aluminium use, as more than a third of all the aluminium currently produced globally originates from recycling routes. Indian aluminium recycling industry is currently un-organized, represented by around 5,000 MSMEs. Current recycling rate in India is only 25% compared to the world average of 45%. Presently, key concern areas of aluminium recycling in the country are complete lack of structure for aluminium scrap handling and secondary metal recovery. On this background, this project has been awarded jointly with Metal Recycling Association of India (MRAI) and outcome of which will help Ministry of Mines in establishing the techno-economic status of the aluminium recycling industry in the country and in due course, help in formulation of policies pertaining to this industry.
Journal Publication


4. Fabrication of AA1050/B4C surface composite by friction Stir processing (FSP) and investigation on mechanical and wear characteristics, Hemendra Patle, Ashish Gupta, **P Mahendiran** and Ravikumar Dumpala; IOP Conference Series: Materials Science and Engineering, 402 (1), 2018.

Conference Proceedings


2. PAT scheme normalization factors for Indian aluminium smelter plants, **A Agnihotri**, V K Jha, & R J Sharma; ICNFMM, Bhubaneswar, 6-7 July 2018.

3. The effects of split ratio on extrusion pressure in a generic tube profile of AA6063 using porthole dies by numerical simulation, **VNSUV Ammu**; One day Conference on Extrusion Dies and Tooling, Pune, 25th July, 2018.

4. Die design for generic tube profile using port hole dies, **VNSUV Ammu**; 7th International Bauxite, Alumina, Aluminium Conference & Exhibition (IBAAS), Mumbai, 5-7 September.

5. Pre-concentration & extraction of strategic rare earths from Indian red mud, **Upendra Singh**, Sonali Thawrani, B R Mishra, Anupam Agnihotri; 7th International Bauxite, Alumina & Aluminium Conference & Exhibition (IBAAS), Mumbai, 5-7 September, 2018.


11. Autogenous dissolution and nano processing of iron in red mud: Green chemistry for value addition and recovery of materials, Mohamed Najar P A, Amrita Karn, Sneha Dwivedi, Priyanka Nayar, Suresh Puttewar and Anupam Agnihotri; Second International Conference on NanoScience and Engineering Applications (ICONSEA-2018), JNTU, Hyderabad, 4-6 October, 2018.


**Invited lectures**

1. Efficient use of aluminium industry waste, waste management in metallurgical industries: Efficient industry practices & Research Initiatives, Anupam Agnihotri; CGCRI-CSIR, Kolkata, 3-4 August 2018.


3. Draft Strategy Resource Efficiency in Aluminium Sector, Anupam Agnihotri; NITI Aayog, New Delhi, 23 August 2018.

4. Aluminium & Green House Gases (GHG): Mitigation & Capture, Anupam Agnihotri; Workshop on Awareness and Capacity Building in Carbon Capture, Storage and Utilization: Recent Advances in CO₂ Capture Technology and Its Sectoral Applications, Climate Change & Research Institute, New Delhi, 31 August 2018.


6. JNARDDC approach to increase extraction and improve plant productivity, Suchita Rai; 1st HINDALCO Alumina Conference 2018 on Alumina Refining Technology: Design and Process Development, Utkal Alumina International Limited, Raygada (Odisha), 4-6 October 2018.


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During the 22nd International Conference on Non-Ferrous Mineral & Metals (ICNFMM-2018) held in New Delhi, Dr Anupam Agnihotri was conferred with the Scientific Excellence Award 2018 at the hands of Shri A G Mukim, Secretary, Ministry of Mines for the dedicated research work on energy efficient techniques related to production and development of Super Thermal Aluminium Alloy (STAL) and high strength aluminium alloys by JNARDDC. This has made JNARDDC family very proud, motivated and committed to scale new heights of performance. We salute Dr Agnihotri for his commendable efforts and achievement.
The 17th Project Evaluation & Review Committee (PERC) meeting held under the Chairmanship of Shri Alok Chandra, Economic Adviser, Ministry of Mines and guidance of Dr Amit Saran, Director (Mines) on 19–20 July 2018 at JNARDDC, Nagpur. Out of 100 project proposals received for the year 2018-19 the expert committee shortlisted 34 projects for presentation during the PERC meeting. The committee evaluated the proposal under three groups namely (i) Exploration and Geo-Sciences & Mining, (ii) Mineral processing and Recovery waste and (iii) Extraction, Alloys, Products & Specialty Materials. Finally 12 proposals were recommended to the SSAG for approval.

Similarly the 18th PERC meeting was also held on 24th Oct 2018 at JNARDDC. A total of 48 project proposals were received in the second phase for the year 2018-19. The committee shortlisted 20 projects out of which only 9 projects were recommended to SSAG for approval. The committee also reviewed six ongoing / completed projects of various institutions.
11वां विश्व हिंदी सम्मेलन

11वां विश्व हिंदी सम्मेलन विदेश संगठन द्वारा मोहिरस संस्थान के सहयोग से 18-20 अगस्त 2018 तक मोहिरस में आयोजित किया गया। इसका उद्देश्य ब्राह्मणों को नए उद्योगों के लिए शिक्षा और संस्कृति दिखाना और इसका आयोजन” के नाम से विश्वविद्यालय अंतरराष्ट्रीय सम्मेलन केंद्र मोहिरस में हुआ। श्री अर. श्रीविपण, वरिष्ठ प्रशासनिक अधिकारी, जे.एन.ए.आर.डी.डी.सी. ने समिति में भाग लिया। परंतु के अनुसार सम्मेलन के दौरान भारत एवं अन्य देशों के हिंदी विद्वानों को हिंदी के क्षेत्र में उनके विशेष योगदान के लिए “विश्व हिंदी सम्मेलन” से सम्बंधित किया गया।

श्रीमती उपजय सरस्वती, भारतीय प्रेम संघ, भारत सरकार और श्री प्रवीण कुमार जनजाती, प्राध्यापक संस्थान, मोहिरस गंगाप्रदेश द्वारा संयूक्त कर से सम्मेलन का उद्घाटन किया गया। दुनिया भर में 2000 से अधिक प्रतिनिधियों ने तीन दिवसीय सम्मेलन में भाग लिया। इस कार्यक्रम का उद्देश्य वैश्विक स्तर पर हिंदी भाषा की पहुंच को विस्तारित करना था।

जवाहरलाल नेहरू एल्युमीनियम अनुसंधान विकास एवं अभिकल्प केंद्र एवं राष्ट्रीय खनिज एवं स्वाभिमान संस्थान, नागपुर में संयुक्त रूप से हिंदी राजभाषा पखावादा का आयोजन

जवाहरलाल नेहरू एल्युमीनियम अनुसंधान विकास एवं अभिकल्प केंद्र एवं राष्ट्रीय खनिज एवं स्वाभिमान संस्थान, नागपुर संयुक्त रूप से हिंदी राजभाषा पखावादा समारोह का आयोजन दिनांक 14/09/2018 से 01/10/2018 के बीच किया गया। उद्घाटन समारोह, मुख्य अतिथि, श्री प्रोफेसर आर.एच. तुपकी, पूर्व तीव्रताधीश, जी.एन.आर.डी.डी.सी. ने नागपुर के कर-कमलो द्वारा सम्बन्धित हुआ।

मुख्य अतिथि ने हिंदी भाषा को जन-साधारण की भाषा रखा के दौरान भाषा भाषा के उत्कृष्टता पर प्रश्न किया। राजस्थान के दौरान विशेषत्व में भाषा भाषा के अंग्रेजी तथा अन्य भाषा के आप्ते विद्वानों का हल सरल तरीके से कहकर शायरे की जाल दी।

संस्थान के विदेशों के अनुमान अधिकों ने पखावादा के दौरान सभी कार्यक्रम कार्य ज्ञान से ज्ञान हिंदी भाषा रखते के करने की कार्यकारीयों से अपील की। उन्होंने निकलो दिया कि आप वाले समय में कार्यक्रम में हिंदी सामाजिकों को भाग लें।

डॉ. एस के सिंह, विदेशक, विदेशों, एन बी एस, नागपुर, ने समापन समारोह में हिंदी भाषा के अवशोषक एवं इसकी ज्ञानार्थक एवं कंपनियाँ को अवाक कर दिया। हिंदी पखावादे के दौरान विभिन्न प्रतियोगिताओं का आयोजन किया गया। वही विश्व में कंपनियाँ तथा हिंदी भाषा के अवस्थक तथा भाषा अवस्थक द्वारा पुरस्कृत किया गया। पद्धति विश्व के पखावादे कार्यक्रम को सफल बनाने के लिए केंद्र तथा केंद्र की उपभोक्ता सभी कार्यकारीयों ने समारोह में भाग लिया। डॉ. उपेन्द्र सिंह, राजभाषा अधिकारी ने संस्थान में हिंदी भाषा के आयोजन वर्तमान कार्य व्याप्त किया। पखावादे के दौरान हिंदी सभी के अन्य सदस्य आर.श्रीविपण, श्री संदीप मेघालुकिय, श्री आर. नेशन एवं एन.एच.एच. ने राजभाषा भाषा भाषा के अधीकरण, श्री एस.एस. एच.एच. ने हिंदी पखावादे के आयोजन में सहयोग दिया।
Brain Storming on “Sharing of Best Practices in Vigilance”

Hindustan Copper Limited and JNARDDC had jointly hosted one day seminar on “Sharing of Best Practices in Vigilance” at JNARDDC on 18th September, 2018 which was attended by Vigilance Officers of various organisations under MoM and WCL and SECL etc. Director JNARDDC in his inaugural address stressed the need for awareness, fear of faith, experience and training, use of technology, collaboration and team work for fighting corruption and eradicating this social evil. Shri Naveen Kumar Singh, Chief Vigilance Officer, HCL detailed the goal of the seminar and outlined scope for discussions. Vigilance officers from different organisations (WCL, MOIL, MECL, HCL etc.) shared their experiences in curbing corruption, in range of areas, employing suitable techniques. It was unanimously agreed to hold such event regularly and include more organisations around Nagpur and effectively fight menace of corruption.

Best Paper Awards

Technical paper titled “Effect of Seed Properties on Liquor Productivity & Product Quality in Precipitation Process for Development of Special Products” presented (at 7th IBAAS- 2018’ held at Mumbai, India, 5–7 September, 2018) by Dr Suchita B. Rai, Principal Scientist, JNARDDC was adjudged as second best paper in session on Non-Metallurgical Bauxite-Alumina and Value from Waste. Our heartiest congratulations to Dr Suchita Rai for her achievement.

Another paper titled “Comparative Study of Phase Transformation of Al₂O₃ Nanoparticles Prepared by Chemical Precipitation and Sol–Gel Auto Combustion Methods” presented (at “2nd International conference on Nano Science and Engineering Applications 2018” held on 4–6 Oct, 2018 at Jawaharlal Nehru Technological University, Hyderabad) by Dr Priyanka Nayar received best paper award. Our heartiest congratulations to Ms Nayar for her achievement.
Governing Body Meeting
The 54th Governing Body and 30th Annual General Body meetings of JNARDDC were held in Delhi on 3rd July, 2018. The board expressed its satisfaction over the progress and internal revenue target achieved. Dr K Rajeswara Rao, AS (Mines) thanked Chairman RAC for providing excellent technical support, guidance in formulating and executing range of research ideas and motivating technical manpower of JNARDDC. The board approved the proposal for nomination of CMD, NALCO as the Deputy Chairman of Governing Body of JNARDDC. We all at JNARDDC heartily welcome Dr T K Chand (CMD) NALCO in our family with whose guidance & support and our dedicated efforts JNARDDC will scale new heights of performance and glory.

Course on “Remote Sensing for Geological Applications”

Team from JNARDDC attended the course on “Remote Sensing for Geological Applications” organized by National Remote Sensing Centre (NRSC), ISRO, Hyderabad during July 16-20, 2018. The course covered preparation of various geological maps with case studies and sharing the expertise in carrying out operational projects in the area of mineral exploration, ground water studies, geohazards and geo environmental studies including hands on practical and demonstration of related softwares. Insight gained will be very helpful in preparing digital databanks on bauxites/laterites using GIS and remote sensing technology.
21st PMC and 35th RAC Meetings

The 21st Project Monitoring Committee of the Centre held its meeting on December 16, 2018 at JNARDDC. The committee thoroughly reviewed four completed projects and the status of nine ongoing projects sponsored by Ministry of Mines, Gov of India, DST and NALCO. The committee complemented the efforts taken for the timely completion of the projects. PMC expressed its satisfaction over the progress achieved and appreciated the scientists and technical staff for the quality output while maintaining the time commitment.

The 35th Research Advisory Committee Meeting was held on 15 December, 2018 at JNARDDC. The committee reviewed the R&D activities of the Centre and was very pleased to have a look at upcoming extrusion press. Dr A K Mukhopadhyay, Member RAC and distinguished Scientist DMRL, promised to utilize the press for defense needs. RAC also conducted the periodical review of Group-A officers under FR-56 (I) and strengthened the hands of JNARDDC by selecting seven new Scientists from different disciplines.
Govt of Maharashtra is committed to plant 50 crore plants in the state within next few years. In 2019, JNARDDC will be contributing significantly by participating in a big way by making available land, manpower and routine upkeep of the saplings that will be planted. Divisional commissioner has directed that modalities may be worked out by Wadi Police and Revenue authorities (in presence of Collector, Nagpur) to sort out cattle trespass nuisance faced by JNARDDC and facilitate Power Grid Corporation who has graciously agreed to provide the surplus funds which can be diverted to JNARDDC for proper fencing and ensuring success of the envisaged plantation programme at JNARDDC.

**Plantation program at JNARDDC**

IBAAS and JNARDDC in association with Aluminium Association of India (AAI) and The Indian Institute of Metals (IIM) organised 7th International Conference & Exhibition (IBAAS-2018) in Mumbai, during September 5 – 7, 2018. Theme of the conference was “Indian Aluminium Industry – Status, Strategies & Way Forward for Accelerated Growth”. Conference was a great success with widespread participation from around the globe (about 220 participants) and presentation of about 75 technical papers covering complete value chain from bauxite to aluminium downstream products.

**IBAAS-2018**

Inaugural function at IBAAS-2018
Vigilance Awareness Week

JNARDDC & NIMH (sister organisation under MOM) jointly organized a Vigilance Awareness Week from 29th October to 3rd November, 2018 keeping in view the theme of “Eradicate Corruption-Build a New India” declared by central vigilance commission. The week function commenced with the Integrity Pledge by all employees of JNARDDC and NIMH and inspiring inaugural discourse by Chief Guest Shri Uday Sinha, Chief Manager, WCL-Nagpur, who emphasized that corruption is a serious unethical practice that weakens trust and confidence, of public in organizations and it can restored only by ethical transparent and integrity in governance system. Director JNARDDC highlighted that Vigilance Awareness Week organised every year is part of a multiple approach of the organization, to promote, guide and participate in the prevention, fight against corruption and to raise public awareness regarding the existence and the threat posed by corruption in the society. Chief vigilance officers of JNARDDC and NIMH briefed about ways and means which can bring down corruption and efforts made so far.

Communal Harmony Week at JNARDDC

Centre has celebrated Communal Harmony Week from 19 - 25 November 2018. On this occasion a competition for the children of employee of the Centre has been organized with the theme “Harmony Day Poster-2018”. The children have shown their talent and prizes were awarded to the winners who have done exceptionally well in the competitions. The exhibition of the painting is also displayed in the Director’s office waiting area.
Spin Coating Machine
JNARDDC has recently procured an Automatic Spin Coating System (EZspinA1) for the deposition of uniform thin film (of thickness of nanometers range) on varieties of flat substrates. This system is equipped with an infra-red chamber heating module as well as ultra violet chamber curing model which will be very useful for insitu heating as well as curing of the sample.

High Energy Planetary Ball Mill
JNARDDC has installed a new PULVERISETTE-5 Premium Line Planetary Ball Mill from FRITSCH, Germany. This mill represents the latest development in milling of particles upto nanorange in very short duration. This instrument goes upto maximum of 800 RPM with centrifugal acceleration as high as 64g. The comminution of the sample material takes place primarily through the high energy impact of grinding balls.
Deep drawing and Cupping Tests Machine (Lloyds – 92NM)

JNARDDC recently procured a Lloyds-92NM deep drawing and cupping test machine for nonferrous and ferrous sheet metal testing which can test sheet/strip in accordance to DIN 50 101 and DIN 50 102. Maximum force and punch stroke are 80kN and 45 mm respectively.

FISCHER ISOSCOPE FMP30 Coating Thickness Meter

A compact handheld device based on eddy current method according to ISO 2360 suitable for determination of the thickness of electrically non-conducting, non-magnetic coatings on non-ferromagnetic electrically conducting base materials has been procured at JNARDDC for anodizing/powder coating thickness measurement on aluminium and its alloys, coatings of paint, lacquer or plastic on aluminium, copper or brass. Equipment can measure the coating thickness in the measurement range: 0 – 1200 μm with very high precision.

Anodisation Set Up

Anodized aluminium parts are commonly found in aircraft and architectural components, as well as consumer goods such as appliances (refrigerators, microwaves, and barbecues), sporting goods (baseball bats, golf carts, and fishing equipment) and electronics (televisions, smartphones, and computers). In order to carry out the research in the relevant areas for aluminium alloys an anodisation setup with 50L tank capacity and sub-zero chiller suitable for soft and hard anodisation has been setup.
Large scale digital database creation of Bauxite and Laterite deposits of Maharashtra State using Geo-informatics technology

Creation of database on Bauxite and Laterite deposits of Maharashtra related to geology, geomorphology & technological characterization by using GIS and remote sensing technology.

Project report comprise plethora of information on Bauxite & Laterite deposits required for processing of ore for metallurgical as well as non-metallurgical applications. The Master Plans Atlas provides at a glance scenario of deposits, extensive information on cadastral, GIS, technological data, etc. The Resource Plans Atlas present data on geology, geomorphology, LULC, soil, slope, etc.
ICNFMM-2019

Corporate Monitor (CM) is organizing **23rd International Conference on Nonferrous Minerals and Metals (ICNFMM 2019)** in association with JNARDDC, AAI, CSIR and CGCRI during 12-13 July, 2019 in Kolkata. The theme of the conference is recycling and utilization of non-ferrous metal processing wastes.

IBAAS-2019

IBAAS is organising **8th International Symposium** from 4th to 6th September 2019 in Guiyang, China. The theme of the conference is "Technological Advances in Alumina, Aluminium Smelter, Downstream Operations, Energy Conservation, Environmental Control and Intelligent Manufacturing with Special Reference to China".
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