

ANNUAL REPORT

2018-19



Jawaharlal Nehru Aluminium Research Development & Design Centre

Autonomous Body under Ministry of Mines, Govt. of India

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Scientific Excellence Award 2018 to JNARDDC

Shri Anil Gopishankar Mukim, Secretary (Mines) awarding the certificate to Director, JNARDDC

[22nd International Conference on Non-Ferrous Mineral & Metals ICNFMM-2018]



JNARDDC - NABL Accredited Lab

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From Director's Desk



I have pleasure in presenting the 30th Annual Report of Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur for the year 2018-19. The performance of the Institute for the year 2018-19 was note worthy in terms of securing NABL accreditation, achievement against the targets, establishment of important facilities, special tests carried out, services offered to Indian and Foreign clients, relations with stake holders, landmark events etc. With the dedicated efforts of our scientific & administrative work force, we have completed ten projects worth ₹ 361.88 lakhs. The Centre is executing five Science & Technology projects approved by SSAG (Ministry of Mines) with a total value of ₹ 206.51lakhs spread over 2-3 years. Eight industry sponsored projects worth ₹ 519.76 lakhs are under execution. Furthermore, several new projects were proposed to various agencies in this year.

The Centre successfully achieved the targets set in the MOU signed with the Ministry of Mines. While carrying out the above R&D work, the Centre achieved an revenue generation (IEBR) of ₹458.91 lakhs. Our scientists have published / presented 39 papers in national & international journals / conferences. Three patent applications were filed for indigenous R&D process developed by JNARDDC. One patent was granted to JNARDDC.

JNARDDC was instrumental in formulating recommendations for Bureau of Indian Standards (BIS) regarding setting up standards for aluminium scrap under the aegis of Bureau of Indian Standard (BIS). Centre is in the last stage of extrusion press commissioning to support the aluminium extrusion industry.

Institute has completed strategy paper on resource efficiency of aluminium under aegis of NITI Aayog/ Ministry of Mines. The report prepared by JNARDDC and DST-TIFAC on "Bauxite-Status, Challenges, Opportunities & Road Ahead" was also released along with other four sectors in presence of NITI Aayog officials.

The Centre has been granted the accreditation (9T-4561) by National Accreditation Board of Testing and Calibration Laboratories (NABL, New Delhi) in Jan 2019. This will lead to further expansion of the testing and consultancy services of JNARDDC.

JNARDDC was awarded with the Scientific Excellence Award 2018 in ICNFM-2018 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

JNARDDC signed five key MOUs with various national and international firms with a view to promote the cause of R&D and consultancy services. (i) Imerys, India (France) (ii) Sterling Educational Systems, Nagpur (iii) Anant Resources, India (Sierra Leone) (iv) Material Recycling Association of India (MRAI) and (v) Consultancy Engineering & Training Institute (CETI), Gurgaon

Bureau of Energy Efficiency (BEE), Ministry of Power has once again renewed the nomination of JNARDDC as a sector expert for the aluminium sector under the PAT-2 /PAT-3 (Perform, Achieve & Trade) Scheme in the National Mission for Enhanced Energy Efficiency (NMEEE) under Climate Change Project.

We acknowledge the support extended by the Ministry of Mines, General Body, Governing Body, Research Advisory Committee, Project Monitoring Committee, all the scientists and staff of the Centre, various aluminium industries (especially NALCO), as well as others (GSI, MECL etc.).

The growth of the global aluminium market is being driven by development in the transport industry, technological advancements in aluminum manufacturing technologies & processing equipment, increase in usage of aluminium in various industries such as building & construction and foil & packaging. Asia-Pacific is the leading region, in terms of growth, due to massive urbanization, growth in income of people living in urban areas, and rapid industrial development. In addition, continuous advancements in transport industry and ongoing R&D activities to develop innovative, more effective, and cheaper aluminum products will fuel the growth of the market. The industry will pave the way for greater investment in R&D for undertaking industry oriented projects. I am proud to say that the centre's visibility and footprint is increasing year after year. I look forward to continued excellent performance of JNARDDC in coming years.

Dr A Agnihotri
Director

About JNARDDC

Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur is a “Centre of Excellence” set up in 1989 to provide major R & D support system for the emerging modern aluminium industry in India by undertaking basic and applied research in the areas of bauxite, alumina and aluminium. It is a 35 crores rupees joint venture, supported almost equally by the Ministry of Mines, Govt. of India and UNDP. The Centre is located in its own sprawling campus just outside the orange city of Nagpur and became fully functional since 1996. With serene surroundings and housed in a modern technical complex with state of art equipments, provide just the right atmosphere for the scientists of the Centre to make creative contributions to the technological growth of the Indian aluminium industry. JNARDDC, an autonomous body of Ministry of Mines is registered under Societies Registration Act, 1860 (455/87-Nagpur dated 13.8.1987) and Bombay Public Trust Act, 1950 (F-6778-Nagpur dated 8.10.1987) as a Trust.

It's a NABL accredited Lab and is recognized as a Scientific & Industrial Research organization by the Department of Scientific & Industrial Research, Ministry of S&T, Govt. of India. It is the only institute of its kind in India pursuing the cause of R&D from bauxite to finished product under one roof for the growth of aluminium Indian industry. The Centre with its limited and highly qualified manpower has developed a brand image for providing quality technical support services to primary and secondary aluminium industries. JNARDDC has made key contribution in the areas of beneficiation, characterization, technological evaluation, up gradation of bauxites, reduction of energy consumption & environmental pollution, by effective utilisation of aluminium industry residue materials such as red mud, dross & scrap etc and process modelling for the benefit of aluminium industry and the nation as a whole.

The Centre also offers analytical and testing facilities to other non-ferrous industries, steel plants, small-scale industries, R&D organisations and academic institutions particularly in the areas of chemical and mineralogical analysis, powder characterisation, thermal mapping, micro structural studies, mechanical and non destructive testing, failure analysis and technical information.

Objectives of the Centre

- 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.

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”.

Bauxite Division

- *Geology and evaluation of bauxite deposits*
- *Beneficiation and up gradation of laterites and bauxites*
- *Total characterisation of bauxites including trace elements and organic carbon*
- *Techno-economic evaluation of bauxite deposits for bauxite production and non metallurgical application*



X Ray Diffraction (XRD)



X-Ray Fluorescence (XRF)



Wet Chemical Lab (WCL)



Glow Discharge Spectrometer (GDS)



Microwave Digestor



**Inductively Coupled Plasma
(ICP-OES)**



**Inductively Coupled Plasma Mass
Spectrometry (ICP-MS)**



Hydro Cyclone



Wet High Intensity Magnetic Separator-WHIMS



Rotary Furnace



High Temperature Furnace



Bond Work Index



Vibrating Screen

Alumina Division

- *Technological testing of bauxite including large scale laboratory tests for desilication, digestion, precipitation and settling*
- *Pre-feasibility and basic engineering package for bauxite mining and alumina plant*
- *Energy audit of alumina plant, foundry, steam plant, chemical plant etc.*
- *Mass and heat balance of Bayer's process*



Auto Clave



Bomb Digester



Potentiometric Titrator



Granulating machine



Large Scale Alumina Pilot plant



Impact Mill

Aluminium Electrolysis Division

- *Electrolysis process control*
- *Cell monitoring*
- *Energy audit*
- *Process monitoring of aluminium electrolytic cell*
- *Mathematical modelling of process including simulation of aluminium smelter process*



Surface Area Analyzer



Real time apparatus



Mobile lab for Aluminium Smelter



Thermal Camera



Bench Scale set up for Cyanide destruction

Downstream Division

- Alloy development
- Melt treatment technology & Primary Casting
- Defect characterisation
- Extrusion Simulation, Friction Stir Welding (FSW)



Scanning Electron Microscope (SEM with EDS EBSD)



Computer Numerically Controlled
Wire Cut Electrical Discharge
Machining (CNC Wirecut EDM)



Universal Testing Machine
U T M

Research Facilities with List of Equipments

Bauxite Division

- Wet Chemical Lab (WCL)
- X-Ray Diffraction (XRD)
- X-Ray Fluorescence Spectrometer (ED-XRF)
- Fusion bead making machine
- Glow Discharge Spectrometer (GDS)
- Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES)
- ICP-MS
- Ion Analyser
- Multi Gravity Separator (MGS)
- TLC Sample Spot Applicator
- Optical Scanning Densitometer
- Petrological Microscope
- High temperature sintering furnace
- Lab flotation machine
- Hydrocyclone test rig
- Granulating instrument
- Rotary furnace
- Wet High Intensity Magnetic Separator
- Size reduction and sample preparation equipment
- Laboratory Ferrous Wheel Separator
- Rotap Sieve Shaker
- Bond Mill Index
- Milli-Q® Integral ultra-pure water purifier
- Planetary Ball Mill

Downstream Division

- 100 kN Universal Testing Machine
- Scanning Electron Microscope +EDS & EBSD
- Vicker's hardness Tester
- Induction Melting Furnace
- Metallurgical Microscope with image analyzer
- Resistivity / High Precision Micro Ohm Meter
- Digital Rockwell Hardness Tester
- Brinell Hardness Tester
- Ultrasonic flaw detector
- Electro polishing machine
- Heat treatment furnaces
- Conductivity meter & Roughness meter
- Milling machine
- Hyperextrude software
- Extrusion modeling and simulation
- Anodizing lab

Alumina Division

- Large Scale Alumina Laboratory
- Laboratory autoclaves, 5 & 10 Litre capacity
- Bomb Digesters
- Total Organic Control (TOC)
- Low Temperature bath equipment
- Equipment for Precipitation Tests
- Angle of repose apparatus
- Brick making unit
- Potentiometric Titrator
- Mathematical Modeling

Aluminium Electrolysis Division

- Specific Surface Area analyser
- Mercury Intrusion Porosimeter
- Helium Pycnometer
- Thermal Analysis System, (TG & DSC)
- Specific Electrical Resistance (Anode)
- Mettler Softening Point Equipment
- Infra Red Thermography
- Three Axis Magnetometer,
- Gauss meter
- Computer controlled Potentiostat / Galvanostat
- Thermal Conductivity Meter
- Photoacoustic Spectrometer (PFC measuring Instrument)
- MOBILE VAN for onsite measurement and studies, fitted with
- Data Acquisition and Processing System
- Heat Flux Meter
- Liquidus temperature measuring kit
- Laboratory Mixing and Kneading Machine

Technological Services

The Centre has offered technological services to outside agencies by utilizing its expertise and analytical facilities. Some of the technological services offered include:

- Beneficiation and up gradation of bauxites / laterites
- Characterization and technological evaluation of bauxites / laterites
- Process monitoring of aluminium electrolysis cell
- Characterization of carbonaceous raw materials CP Coke and CT Pitch
- Chemical, Physical and Physico-chemical analysis
- Energy auditing and PFC measurements
- Alloy development and forming of aluminium alloys
- Microstructural, mechanical, electrical, EBSD characterization
- Melt loss assessment and remedial measures
- Process modelling

Our Major Clients

OUR ASSOCIATES



Projects Completed in 2018-19 :: 10 nos.

(S-21) Synergistic utilization of aluminium industrial wastes for development of geopolymeric building materials : S&T Mines & Swarnalata Holdings, Raipur



Objective:

- To develop marketable building materials such as brick, block and tiles from geopolymerized raw material combinations.
- To study the environmental impact of geopolymerized building materials
- To explore the scope of value addition of the products with respect to market and demand based on the input from entrepreneur.
- To carry out the mini pilot plant trial for verifying scope for commercialization.

Background:

In the recent past JNARDDC has developed simple and cost-effective process for management of major solid wastes generated at the aluminium industry. Subsequently the R&D efforts were focused on the development of viable products that consume bulk volumes of different solid rejects. Since the infrastructural development across the land is booming with great potential of consuming large volumes of solid rejects, the above R&D work was undertaken for development of economically viable products.

A wide variety of solid rejects viz., fly ash, red mud and other mining rejects such as saprolite, lateritic overburden, partially lateritic khondalite (PLK) and kaolinitic khondalite (KK) etc. were used for making geopolymer based building materials. Other locally available waste materials such as variety of clays, ash, effluents, sediments as well as major solid wastes from other industries (steel, power, oil, and biomass) were also found useful for making green building materials.

Exploitation of by-product synergy is a growing practice worldwide. It consists in the maximization of resources utilization with the replacement of natural or costly raw materials by by-products as inputs for industrial processes. Successful utilization of rejects is the best option for resource augmentation and management especially with the participation of an industry partner.

Outcome:



The concept of synergistic utilization of these materials has been successfully achieved for generation of quality building products suitable for urban and rural building application. The present study verified impact of atmospheric moisture, effect of soda content and efflorescence, improvement of crushing strength and value addition of product based on physical modification.

Developed the following products:

- a) Hard geopolymer bricks (non-fired, crushing strength ranging 5-15 MPa)
 - b) Light weight geopolymer bricks (non-fired, crushing strength ranging 5-10 MPa)
 - c) Hard fibre reinforced geopolymer blocks/ bricks (non-fired, crushing strength ranging 30-45 MPa)
 - d) Hard high strength paver blocks ((non-fired, crushing strength ranging 30-42 MPa)
 - e) Light weight foamed geopolymer bricks (non-fired, crushing strength ranging 5-8 MPa)
 - f) Light weight foamed and layered geopolymer bricks (non-fired, crushing strength ranging 5-8 MPa)
 - g) Sandwich type geopolymer (multi layered, non-fired, crushing strength ranging 4-8 MPa)
- Mini pilot plant studies and cost estimation of geopolymer products were carried out successfully in collaboration with Entrepreneur (M/s. Swarnalatha Holding, Raipur, Chhattisgarh) : Capacity 300 bricks per cycle (4 cycles per 8 h)
 - The process is ready for the next level production viz setting up of a pilot plant by the Entrepreneur for commercializing the technology after working out the techno-economics.

(S - 22) Developing downstream application of strip cast aluminium alloys (AA8011 and AA3004), S &T Mines, NALCO and VNIT, Nagpur



**Obj
ecti
ve:**

Dev
elop

processing parameters to develop microstructure/texture suitable for increasing the formability by optimizing the thermo-mechanical processing (continuous casting, cold rolling, annealing) and to improve the surface characteristics by anodizing.

Background:

The demand for aluminium alloys has been continuously increasing in automotive, appliance and food industries owing to their light weight and good corrosion resistance. For instance, the use of aluminium sheet material for typical automobile body parts could provide a mass reduction of up to 50 percent as compared to current steel construction. This could result in overall reduction of the vehicle and correspondingly fuel consumption. However, despite having high strength to weight ratio aluminium and its alloys are lagging far behind as compared to steel because of their poor formability at room temperature (approximately 2/3 of that of steel).

Improvement of formability is of special interest for the automotive, appliance and food industries, where weight reduction is compulsory and panels to be formed have intricate shapes. In this regard the above project was undertaken to develop microstructure/texture suitable for increasing the formability to improve the surface characteristics by anodizing for developing downstream application for strip cast aluminium alloys.

Outcome:



The deformation and recrystallization behavior of strip-cast AA8011 alloy was studied and optimized. Based on microstructure and texture, a deformation-time-temperature combination was found out, where the formability of the sheet metal was maximum. The sheets supplied by NALCO were characterized for

microstructure and texture. Optimum clamping force was found out for different thicknesses. Annealing at 450°C for 1h followed by microstructure/texture characterization, deep drawing tests and stretching tests revealed that the annealed sheets had higher formability due to increased grain size and softness of the material.

- Relationship between coating thickness and time was prepared for different thicknesses of sheets, which can be used to impart a specific thickness to the sheet metal.
- Successful lab scale trails were taken for preparing sample number plates.
- The findings shall be taken up with the industry for industrial applications.



(S-23) Effect of modified seed properties in precipitation of aluminium hydroxide from Bayer liquor : S&T (Mines)



Objective:

- New process and product development in precipitation
- Explore the possibility of using modified seed hydrate to enhance the yield.
- To reduce the energy consumption by establishing parameters to produce gibbsite / boehmite alumina hydrate
- Study kinetics/ mechanism of precipitation with respect to seed surface property by using thermally activated seed (TAS)
- Comparison of precipitation kinetics with TAS and conventional seed

Background:

Special grade hydrate is presently produced by grinding and thermally activating conventional alumina hydrate. Gibbsite alumina hydrate is being used in calcination. R&D work was undertaken by JNARDDC to modify the properties of aluminium hydroxide seed hydrate with a view to enhance yield of gibbsite / boehmite alumina hydrate with reduced energy consumption. The project also aimed at improving liquor productivity, formation of new products and development of new process.

Outcome:

❖ **Development of following processes:**

- Precipitation process using mechanically activated seed to produce fine alumina hydrate. Presently produced by grinding of conventional seed hydrate
- Precipitation process for producing coarse and fine high surface area alumina hydrate
- Precipitation process using boehmite seed to produce boehmite alumina hydrate
- Calcination (parameters) of boehmite hydrate to produce smelter- grade alumina
- Process for producing coarse and fine high surface area gamma alumina

❖ **Developed the following products using precipitation route:**

- Fine hydrate (d_{50} : 10-12 microns)
- Coarse (d_{50} : 90-100 microns) and fine size (d_{50} : 10-12 microns) activated alumina having high specific surface area ($150-350 \text{ m}^2/\text{g}$)
- Coarse (d_{50} : 90-100 microns) and fine (d_{50} : 10-12 microns) boehmite hydrate
- Coarse (d_{50} : 90-100 microns) and fine size (d_{50} : 10-12 microns) gamma alumina having high surface area ($80-105 \text{ m}^2/\text{g}$)



❖ Smelter grade alumina from boehmite hydrate

❖ In an existing plant, the mechanically/ thermally activated seed or boehmite seed can be used in few of the precipitators, parallel to the conventional seed precipitators to obtain special product which will have high commercial value as a hydrate or may be partially calcined to obtain high-value product.

❖ Alumina with specific surface area in the range of $60 \text{ m}^2/\text{g}$ to $70 \text{ m}^2/\text{g}$, 94 % particles above +45micron size, and loss on ignition (LOI) <1% in the temperature range $300-1000^\circ\text{C}$ using boehmite hydrate was achieved at a calcination temperature of $650-700^\circ\text{C}$ as compared to present calcination temperature of $1000-1100^\circ\text{C}$. This will reduce about 50% energy in calcination.

❖ Based on the encouraging lab scale results for boehmite precipitation and calcination studies, the next phase of R&D project needs to be undertaken with the support of the Govt. and alumina refinery to scale up the process to bench scale level.

(S-24) Large scale digital database creation of Bauxite and Laterite deposits of Maharashtra State using geo-informatics technology: S&T (Mines), MRSAC and GSI, Nagpur



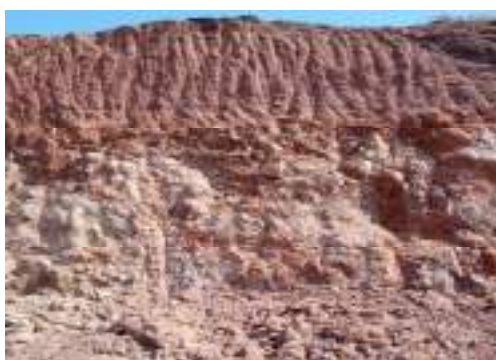
Objective:

- Creation of digital database on Bauxite and Laterite deposits of Maharashtra related to geology, geomorphology & technological characterization by using GIS and remote sensing technology
- Use of modern geo-informatics technology in the era of lateritic bauxite deposits/mines for environmental management and sustainable development

Background:

Till date, Geological Survey of India (GSI) & other organisations have evaluated / characterised bauxite & laterite deposits mainly from geological and chemical point of view. However, the increasing demand of the raw minerals and its management has created a need to develop a digital database along with the technological information of individual deposits useful for aluminium industries. The attribute information collected for geotechnical information of the laterite and bauxite deposits when integrated with the GIS database, in spatial domain will provide a new perspective, vital for the bauxite alumina industry.

Hence the above project was undertaken for evaluation of laterite and bauxite deposits of Maharashtra State on district wise basis, in association with the geo-referenced cadastral maps and high resolution satellite imageries so that a ready reference is available to the industry and end users. The project signifies the unified effort of three domain specific organization namely JNARDDC, GSI and MRSAC.



Outcome:

- The outcome of the project is the generation of exhaustive and comprehensive digital database of laterite and bauxite deposits in geospatial domain. Multiple unique outputs like GeoPDF, KML, 3D offline HTML and GIS projects have been generated.
- The added advantage is that the procedures and methods can be replicated for other region/states such as Chhattisgarh, Eastern ghat, Western ghat and Gujarat which are bestowed with the laterite and bauxite deposits.
- Geo-informatics technology can effectively be used to combine information such as cadastral boundaries, geomorphology, resources, pre-field investigation perception, identification of prospective deposits/ area, demarcation of rock/ ore bodies, etc. with the geo-technological data
- Entrepreneurs can identify deposits suitable for metallurgical and non-metallurgical applications. Cluster of deposits can be used for industrial applications.
- The Directorate of Geology & Mining (DGM), Govt of Maharashtra has appreciated the work stating that it will attract prospective miners and ease the auction process.



(S-27) Estimation of Morphodynamicity and its remedial action using Red-mud based concrete at coastal zone of Eastern Odisha : S&T (Mines)and IIT, Bhubaneswar



Objective :

Utilization of stabilized red mud / geopolymer blocks for application in controlling sea bed erosion.

The process includes three major aspects

- (a) Laboratory scale product optimization (fine tuning etc) for production of stabilized red mud and geopolymer blocks
- (b) Study of physical and chemical properties of prepared blocks
- (c) Identifying the coastal area in Kendraparha area in Odisha coastline for field trial

Background :



India being a peninsula has a coastline of 7516.6 Km which is undergoing constant erosion. In phase-1 of the above project it was proposed to develop some materials for controlling sea bed erosion. At present tetrapods made of concrete are used as wave-dissipating blocks in coastal areas.

In this regard, an initiative was made to replace these concrete blocks with blocks made of industrial waste with the overall objective of waste utilization. Aluminium industry is generating a large amount of waste namely red mud which can be utilized for preparing fired stabilized red mud and geopolymer concrete blocks for controlling sea bed erosion. These blocks exhibit good strength and can substitute conventional rocks and cement concrete blocks thus saving natural resources and utilizing waste generated from aluminium industry which is presently lying unused in red mud ponds.

Outcome :

- The phase-1 studies led to the successful development of red mud based stabilized fired red mud bricks prepared using 70 % red mud, 25 % high silica plastic clay and 5 % Talc exhibit good compressive strength (25-28 N/mm²), moderate water absorption (18-19 %), almost nil efflorescence & almost negligible leachability of caustic soda in sea water.
- The geopolymer concrete blocks prepared by IIT, Bhubaneswar, Odisha also show a good compressive strength above 40 N / mm² and it utilizes around 35 % of red mud and 65 % fly ash along with sand & caustic soda/sodium silicate.
- The cost of Blocks/metre length 3 rows is ₹ 2,150/m for stabilized hard blocks and ₹ 2,325/m for geopolymer concrete blocks + cost of transportation.
- The costal site proposed suggested by Orissa state pollution control board and Chilka development authority in the area of duhadia river muhana close to the Puri beach which enters the bay of Bengal is presently no approachable by road. Thereby it will pose the problem of transporting the blocks to the beach location.
- The Centre has approached the Odisha state pollution control board and District authorities to suggest further sites facing the problem of erosion so that the second phase of the project i.e field trials with blocks and use of simulation software for modelling can be carried out.
- From the above studies it is was concluded that the blocks are much more cheaper as compared to cement concrete blocks and moreover it would lead to utilization of industrial waste.

(S-28) Status report on work carried out nationally and internationally on Red Mud to benchmark future investigation in the country : S&T (Mines)



Objective:

- To prepare status report on work carried out nationally and internationally on red mud.
- Identify the most promising and economical viable solution for bulk utilization of red mud.

Background:

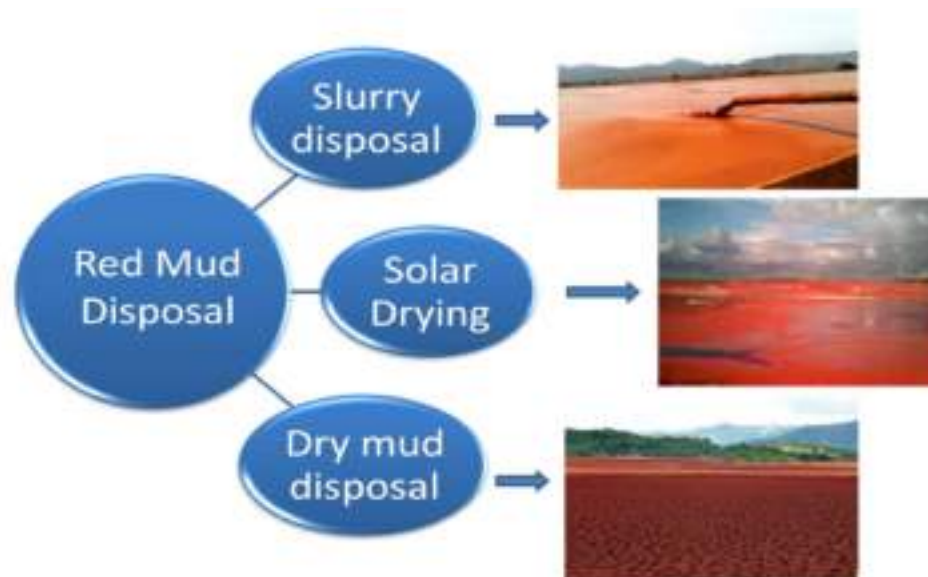


Red mud is an insoluble product generated during the Bayer's process of alumina production. Generally, 1-2.5 tonnes of red mud is generated per tonne of alumina produced. Red mud is alkaline in nature due to processing of bauxite with caustic soda solution at elevated temperatures which poses a serious environmental hazard. Present worldwide generation of red mud is about 150 million tonnes while about 2.5 billion tonnes of the bauxite residue remains stored in the landfills. Owing to its disposal in huge amount, it has become difficult to handle and manage in a sustainable way. JNARDDC has prepared a detailed status report on work carried out nationally and internationally on red mud to benchmark the future investigation in the country. It will help the industry to explore possible bulk scale utilization of red mud and better waste management by avoiding repetitive R&D work.

Outcome:

- The major obstacle in bulk use / long term storage of red mud is due to its complex mineralogical & chemical composition, extreme fineness, poor settling, poor dewatering characteristics, highly alkaline nature, seepage of alkali into groundwater thereby posing environmental threat.
- Extensive work on lab scale has been done in manufacturing bricks and blocks. Only a few have been tried at pilot scale level. R&D funding should henceforth be limited to the pilot plant level projects with a view to commercialize the production and use of bricks / blocks with techno-economic feasibility. Emphasis should be on projects / plants which can be set up in near vicinity to the alumina refinery with a view to mitigate the transportation cost of red mud.

- Govt policies / guidelines need to be put in place on similar lines of fly ash utilisation with a view to take up production and sale / distribution of red mud bricks / blocks. It could also be taken up as a corporate social responsibility (CSR) by the concerned industry. Certain subsidies may be given to the user industry by the government as an environmental sustainable initiative.
- There is sufficient scope for sustainable use of red mud for road construction as an embankment landfill, soil stabilizer, as an additive/ durability enhancer e.g. sand manufacturing, special cement, refilling the abandoned bauxite mining open pits. Construction and cement industry should be encouraged for utilizing red mud in above applications.
- Research programs can be encouraged to explore the possibility of use of red mud in vegetation cover. Use of red mud in agriculture may improve the water retention capacity of sandy soils.
- Similarly a lot of work on lab scale has been undertaken for recovery of iron, titanium and rare earth valuables from red mud. The focus should shift to pilot scale trails to evaluate the techno-economy feasibility of recovery of metals.



- There is a need to focus more on the safe storage of red mud. Proper disposal strategies should be implemented by the alumina refineries and an audit of disposal ponds should be done by an authorised agency appointed by the government.
- Red mud should be categorized into two groups namely iron rich red mud and moderate Fe_2O_3 and TiO_2 -rich red mud and the decision to undertake further R&D work should be based on the above classification.

(N-40) Mechanical activation of bauxite followed by technological studies. NALCO**Objective :**

- To investigate the effect of mechanical activation of bauxite on desilication, digestion and settling process steps.
- Explore dissolution and digestion of both low silica (1.5-2.5% reactive silica) and high silica (5-6% reactive silica) bauxites in an attrition mill and study its effect in terms of acceptable silica level in the liquor, digestion efficiency and caustic soda losses in the mud.

Background:

Mechanical activation is a pretreatment process prior to the leaching of minerals. The process involves milling in a high energy mill to produce finely ground particles that exhibit enhanced dissolution rates in addition to the effects of increased specific surface area on dissolution. The resulting creation of fine particles, the increase in surface area and formation of deformed structures accelerate the leaching process. The project work was undertaken to evaluate the use of mechanical activation technique for achieving better digestion efficiency.

In this project, studies were carried out taking plant parameters into consideration such as initial liquor concentration, target RP and time duration at a fixed digestion temperature of 90°C. In low silica bauxite, significant digestion efficiency was achieved with mechanical activation (91% digestion efficiency obtained at target RP 1.0 and 90°C) but silica in the liquor is 2.6 g/l. In high silica bauxite, maximum digestion efficiency achieved is 71% at target RP 1.0 and 1.3-1.6 g/l SiO₂ concentration in liquor. In both cases, the silica concentration in the digested sodium aluminate liquor is considerably high which is not suitable to be carried on to further process steps. Though the caustic soda losses in the mud are significantly low, the high silica level in the liquor after digestion makes it necessary to go for pre-desilication. However, pre-desilication reduces the digestion efficiency in both the bauxites. Pre-desilication to get silica concentration up to 1 g/l in the liquor decreases the digestion efficiency by about 6-7 % in low silica bauxite while for high silica bauxite it reduces by about 20-25%.

Outcome :

The experimental results are encouraging and have shown that pre-desilication is an essential step to be carried out prior to digestion to achieve an acceptable silica level in the liquor.

(N-41) Studies on trace impurities, it's behavior & control in Bayer's process with respect to reduction in product hydrate. NALCO



Objective :

The main objectives of the research project are

- Studies on Bayer's liquor Impurities (i.e. P, K, Ga, V, Ti, Mg, Zn Etc) and its quantification.
- To understand the behavior and profile of impurities in different unit operations.
- Study the scope for the control of impurities from plant liquor with an objective to reduce impurity in the hydrate.

Background :

The Bayer process is the most economical method for the production of alumina, which is further reduced to aluminium, from aluminium containing ores such as bauxite. However, there are number of contaminants of concern found in the ores, the more serious of which include the trace impurities namely Ga, V, P, K, Mg, Ti Zn etc. Moreover, due to the recycling of the Bayer Liquor, more impurities are constantly introduced into the liquor and subsequently concentrated. There are several major concerns regarding the presence of these impurities in Bayer Liquor. These trace impurities have the most significant effect on both process and product. The quality and quantity of alumina produced from the Bayer process is reduced.

Identification, recoveries and removal of valuable minor/trace impurities are an issue with respect to Indian bauxite while processing in existing refineries. More than 30 trace/REE metal elements are present in bauxite and they range widely abundance. The occurrence of impurities in Indian bauxite have been reported in sufficient quantity which need to be investigated and either recovered or removed during bauxite processing from liquor.



Work at Alumina Refinery, NALCO Damanjodi

Outcome :

Based on experimental results, several conclusions and recommendations were offered.

Digestion and Dissolution Behavior of Trace Elements

Digestion studies show that dissolution behaviour of trace impurities in caustic fluid. The percentage dissolution of trace impurities in synthetic/pure liquor as well as plant liquor. From data obtained, it was observed that the dissolution behaviour of Ti, Mg & Zn was similar in both digestion, very little amount of these elements were dissolved in caustic fluid and maximum quantity goes into residue i.e. red mud. About 66% of gallium was dissolved in synthetic liquor and 40% of gallium gets dissolved in plant liquor. From the plant liquor, 50% of gallium entering in the process gets precipitated with alumina. The impurity however, has no adverse effect on the quality of smelter grade alumina. Potassium is most soluble in caustic fluid about 99% of potassium gets dissolved in synthetic liquor while dissolution percentage was 46% in plant liquor. Potassium also has no adverse effect on the quality of alumina and efficiency of plant. About 40% of vanadium was dissolved in synthetic liquor and 35% dissolved in plant liquor, vanadium appears in the form of VO₄³⁻. About 34% of phosphorous was dissolved in synthetic liquor and 32% phosphorous dissolved in plant liquor, this soluble phosphate in liquor lead to alumina losses from the Bayer circuit due to its effect on liquor stability.

Equilibrium Solubility

The cooling of evaporated Bayer liquor resulted in a precipitate comprising of impurities in form of salts of P, V, Ga, Mg, Ti, Zn etc. Therefore, the equilibrium solubility for these impurities has been studied in plant liquor as well as in synthetic/pure liquor to evaluate the saturation level of impurities. The solubility of these impurities was carried out at 60 °C and caustic concentrations was maintained between 150-155 gNa₂O/L. Solubility of sodium salts of Phosphorous, Vanadium, zinc oxide, Titanium oxide and Magnesium sulphate in synthetic/pure liquor was more as compared to the plant liquor.

Reduction of impurities in Bayer liquor

A majority of the impurities are not soluble in the Bayer liquor and settle out as red mud which is then removed. However some trace impurities such as P, V, Ga, Mg, Zn & K are soluble in the Bayer liquor and dissolved into solution along with alumina. Thus the process provides reagents for the reduction/removal of trace impurities from the Bayer liquor by the addition which is not corrosive. The reagents are added individually or in combination thereof to the Bayer liquor for the removal of trace impurities. The reagents form a complex with the trace impurities for the precipitation of the impurities from the caustic fluid stream. Once a complex is formed, the Bayer liquor is held in a quiescent state for a period of time sufficient for settling out of solution the precipitate. After settling out of solution, the precipitate is separated and removed, and the Bayer liquor is then further processed into alumina.

Lime Causticization

Lime (CaO) was added stoichiometrically to Bayer liquor (WOF 3rd) depending on the total soda concentration and C/S ratio. The results obtained for the batch causticization of washer overflow (3rd stage) of the Bayer process which highlights the influence of lime charge of liquor concentration and causticization reaction with respect to reduction in impurity. In the present study it is revealed that for highest (>90%) reduction of trace impurities keeping C/S ratio more than 0.9 could be achieved by further addition of lime to be around 2.5–3 times in the present practices at plant level.

The final report recommended various methods and process for reducing the trace impurities in Bayer liquor with the objective to reduce the impurities in the final product hydrate.

(P-56) Characterization study and technical assessment of raw materials & related products.**Hi-Tech Metafluxes, Raipur****Hi-Tech Metafluxes : Raipur****Objective :**

The aim of the proposed research were :

- Complete characterization of raw materials and finished product
- Prepare a mass balance and technical report

Background :

Hi-Tech Metafluxes is a leading manufacturer of whole range of fluxes for the ferrous and non-ferrous foundry and refining industry in central India. Basically they are manufacturing several products such as Al-Mix, Metric Super, Slag Treat powder, Teeming Powder, Ladle covering compound, Synthetic Slag, Carbon Additives and Tundish Powder/ Casting Powder using waste/process rejects such as dross, waste carbon dust, shot blast dust & carbon bath/ skimmed bath of Indian aluminium industries and other non-hazardous raw materials like Lime, Soda, Rice Husk, Mill Scale, Graphite powder & Cement.

In the proposed work, the studies are focused on the characterization and technical assessment of raw materials and related products. Characterization including the analysis of Al, Nitride, Fluorides, Silicon, phosphorous, Alumina, Vanadium, Sodium, Chromium, Manganese, Arsenic, Cadmium, Cobalt, Copper, Nickel, Antimony (except thorium). Study will help in better understanding and also the balancing of these elements in raw materials with respect to their related products.

Outcome:***Raw Material and Product Preparation and Characterization***

Products (fluxes such as Metric Super, Slag Treat Powder, Teeming Powder, Ladle Covering Compound (LCC), Synthetic Slag, Carbon Additives and Tundish Powder/Casting Powder) were collected from the industry. The synthetic samples were prepared from the waste/process rejects such as dross, waste carbon dust, shot blast dust & carbon bath/skimmed bath of Indian aluminium industries and other non-hazardous raw materials like Lime, Soda, Rice Husk, Mill Scale, Graphite powder & Cement for the ferrous and non-ferrous foundry and refining industry. These fluxes are very useful in steel industries during process to avoid loss of heat, materials and less slag formations are takes place, also help to produce good quality of products.

Basic characterization of raw materials and related products both synthetic and actual were carried out by wet chemical method and ICP-OES.

Mass balance of studies was carried out with product and their raw material using both synthetic and original product which was found to have close resemblance with calculated and obtained value.

Estimation of nitride was carried out by distillation process followed by titration and the results obtained were summarized. Mass balance of finish products for aluminium nitride (AlN) were presented.

Estimation of leachable and total fluoride was carried out by leaching (only stirring) and distillation process respectively. The fluoride was measured by ion analyzer and the results obtained were summarized. Mass balance of finish products for Fluoride (F) was also done.

Toxicity Characteristics Leaching Process (TCLP)

TCLP were carried out to study the environmental aspects of constituent elements in the raw materials and finish products for the leachable hazardous level chemical entity and the results obtained were incorporated in the final report which gives the detailed information about leachability of each elements. Values obtained for TCLP test for finish products were found to be matching with respect to the values obtained for raw materials and complete TCLP data were presented.

The complete characterization of raw materials and finished product was done and a mass balance was submitted in the final technical report. The final report will help in better understanding and also balancing of these elements in raw materials with respect to their related products.

(P-57) Supply of Equipment for online bath measurement. HINDALCO, Hirakud**Objective :**

Development of an instrument for real-time measurement of following Important bath parameters of aluminium electrolysis cell:

- Bath ratio,
- Concentration excess AlF_3
- Concentration of free Alumina
- Operating Temperature
- Liquidus temperature
- Superheat temperature

Background :

The Hall-Héroult process is a well-established conventional process for producing aluminium in a smelting operation in an electrolytic cell. In a conventional Hall cell, alumina is electrolytically reduced to aluminium in a molten electrolytic bath generally composed of sodium cryolite (Na_3AlF_6) and aluminium fluoride (AlF_3) as well as other additives. Alumina (Al_2O_3) is introduced into the molten electrolyte bath, dissolves and reacts to form carbon dioxide and aluminium that accumulates as molten aluminium pad. Control parameters monitored during an aluminium smelting operation include the temperature of the bath and the composition of the molten electrolytic bath. Typically, samples of electrolyte are periodically withdrawn from the Hall cell and analyzed for the concentration of alumina and the ratio of the concentration of NaF to the concentration of AlF_3 (termed the bath ratio) in laboratory batch tests. Such laboratory tests are typically completed several hours or days after the sampling occurs with little indication of current process conditions. With a view to address the above program, JNARDDC undertook the project to develop an Instrument to unite all the measurement in to one single measurement (with minimum measurement time 5-7 minutes) which can be used to control the cells on the basis of real time bath parameters. This Instrument will provide all the critical real time information necessary for optimal control of the cell.

The final Instrument has been developed successfully for HINDALCO HIRAKUD. Wi-Fi enabled Data Acquisition system and Electromagnetic compatible tablet was incorporated for ease of operation. The instrument consists of following parts:

- Wi-Fi enabled High speed Data acquisition System
- A probe having thermocouple arrangement (thermocouple and crucibles are consumables)
- Electromagnetic compatible Toughpad with Docking Station (Dual RF)
- Portable Trolley



Outcome:

Plant trials were carried out at Hindalco, HIRAKUD smelter plant with the new instrument and measurement was done successfully for more than 30 pots. Trained the plant personals for operation of the instrument and software part. Instrument along with required spare parts has been handed over to Hindalco, HIRAKUD plant and provided practical demonstration. Instrument is being successfully used on regular basis by Hindalco, HIRAKUD smelter plant personnel. This Instrument provides all the critical real time information necessary for optimal control of the cell.



JNARDDC personnel providing plant trails of the instrument at HINDALC, HIRAKUD

Ongoing Projects 2018-19 : 13 nos.

Sponsored by Ministry of Mines (SSAG) :

SN	Project details	Objectives / outcomes
1.	<p>S-25 : Nano Processing of Industrial Rejects for use as additives in Mixdesigns for improved pozzolanic reaction efficiency with VNIT.</p> <p>Zero date: Feb.2018</p> <p>Duration: 2 yrs</p>	<p>A cost-effective way for preparation of nano-particles/nano-composites using industrial wastes as precursors rather than expensive chemicals will be achieved as the project deliverable. The project outcome would result in reduced used of binder (cement) which shall be substituted by the above nano-materials. R&D outcome aims for economic and efficient building and construction work.</p>
2.	<p>S-26 : Fabrication of Advanced Ceramic Nano-coatings for Automotive Applications with Christ University.</p> <p>Zero date: April 2018</p> <p>Duration: 2 yrs</p>	<p>The project deliverables include development of a technology to prepare nano sized plasma spray powder from nano ceramic (commercial) compositions involving alumina and zirconia (in line with Make in India Concept). The outcome of the project could lead to overall import substitution in the field of automotive sector applications.</p>
3.	<p>S-29 : Techno-economic Survey of Aluminium Scrap Recycling in India with MRAI (Metal Recycling Association of India)</p> <p>Zero date: Oct 2018</p> <p>Duration: 1 yr</p>	<p>Indian aluminium recycling industry is currently considered as un-organized, which is represented by around 5,000 Micro Small and Medium Enterprises. Scrap collection is largely unorganised coupled with insufficient awareness, leading to a major proportion of scrap going to landfill rather than recycling. Current recycling rate in India is only 25% compared to the world average of 45%. The country has a long way to go before it can become a major aluminium recycler and feed the secondary metal market which is dependent on imports. India is yet to emerge in a big way as an aluminium recycling country. Presently key concern areas of aluminium recycling in the country are complete lack of structure for aluminium scrap handling and secondary metal recovery.</p> <p>The proposed survey will assist the 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 beneficial to this industry.</p>

SN	Project details	Objectives / outcomes
4.	<p>S-30 : To study the fire retardancy of nano-ATH in polymers with CIPET (Central Institute of Plastics& Engineering Technology)</p> <p>Zero date: Oct 2018</p> <p>Duration: 2 yrs</p>	<p>Aluminium hydroxide is a common inorganic additive used in a wide range of industrial applications. One of its applications is its use as a fire retardant. Polymer based materials are now recognized as key components in many important industries such as construction, automotive, electronic and aerospace due to their outstanding physical and electronic properties, cost-effectiveness, high versatility, and portability. However, one severe problem with many polymers is that they are highly flammable and can produce large amounts of toxic smoke during combustion, which poses a great threat to human safety. In order to tackle this problem the project has been undertaken to explore the use of Nano-ATH as flame retardant fillers into polymer matrices because of its specific properties of high surface area and good dispersibility. The project aims to develop new process and product using aluminium trihydroxide and polymer matrix for various applications.</p>
5.	<p>S-31: Bench scale study on extraction of pure Silica and smelter grade Aluminium Fluoride from Coal Fly Ash (CFA)- S&T (Mines)</p> <p>Zero date: Mar 2019</p> <p>Duration: 1 ½ yrs</p>	<p>Coal Fly Ash (CFA) is one of the solid waste generated in thermal power plants during the process of power generation. India's commercial energy demand is met through the country's vast coal reserves and the coal fly ash generating from all coal-based thermal power plants are accumulating over the years which typically contains 27-31% alumina (Al₂O₃), 56-60% silica (SiO₂) and 9-13% oxides of elements (Ca, Mg, Na, Fe, Ti etc.).</p> <p>Pure silica is used in structural materials, microelectronics (as an electrical insulator, semiconductors etc.), and as components in the food and pharmaceutical industries.</p> <p>In this project work efforts will be carried out to study bench scale (0.5-1 kg CFA) extraction of pure silica and aluminium fluoride by treating coal fly ash (CFA) with appropriate mineral acid.</p>

(B) Sponsored by Industry / other organizations (Ongoing)

S.N	Sponsoring agency	Title	Zero date Duration	Remarks / Outcomes
6.	NALCO, Bhubaneswar Odisha	N-42: Utilization of PLK (Partially Lateritised Khondalite) as a potential and value added filler material with specific reference to white ceramics and pigments	(Feb 2017) 2 ¾ yrs	It is a joint project undertaken with CV Raman College of Engineering. The main objective of the project is to develop a process for utilizing Partially Lateritised Khondalite (PLK) as a potential and value added filler material for manufacturing white Ceramics and pigments. The work will involve the following sub objectives and deliverables : Optimization of physic-chemical beneficiation separation / leaching process to reduce iron content in PLK , Formulation of raw mix with an acceptable limit of iron of <5% ; Processing of treated PLK/raw mix for white ceramic products and pigments with validation of its suitability and preliminary economics study. The process being innovative would generate IPR, publications and the report would comprise the details of study with Characterization of data.
7.	NALCO, Bhubaneswar Odisha	N-43: Development of inline automated anode butt monitoring system to measure anode butt parameters	(Feb 2018) 1 ½ yrs	The project aims to develop an automated visual inspection system of anode butts processed at the rod shop for overall energy savings.
8.	NALCO, Bhubaneswar Odisha	N-44: Development of Wi-Fi enabled sensor arrangement for online measurement of anode current distribution of aluminium electrolysis cell	(Feb 2018) 2 yrs	The project will lead to the development of wi-fi enabled sensor arrangement for online measurement of anode current distribution of aluminium electrolysis cell for leading to energy savings.

S.N	Sponsoring agency	Title	Zero date Duration	Remarks / Outcomes
9.	NALCO, Bhubaneswar Odisha	N-45: Development of ceramic proppant from low grade materials (Partially Lateritised Khondalite -PLK, Fly ash, etc.) - Phase-II-Scale up studies :	(Feb 2018) 2 ½ yrs	The project aims to develop ceramic proppant from low grade materials (Partially Lateritised Khondalite -PLK, Fly ash, etc.) - Phase-II-Scale up studies which will be an extension of the successful lab scale process already developed by JNARDDC.
10.	Ministry / Dept. of Science and Technology (DST)	P-55: Utilization and development of process for recovery of strategic rare earths from industrial waste –Bauxite Residue at lab scale.	(Mar 2017) 3yrs	The project aims to recover invaluable rare earths from industrial waste. It involves physical beneficiation /pre-concentration of bauxite residue using multi-gravity separator / Hydrocyclone test, characterization of various size fractions for major, minor and REEs and leaching study using different mineral acid and sulphate ion roasting. It will lead to recovery of rare earth elements such as scandium (Sc), lanthanum (La) and cerium (Ce)
11.	VEDANTA Odisha	P-58: Technological characterization of Bauxite sample for establishing the mass balance of the process design of the expansion study at Vedanta Ltd, Lanjigarh, Kalahandi, Odisha.	(4 months) Feb 2019	The expansion study at Lanjigarh, Kalahandi, Odisha by VEDANTA is being technically supported by JNARDDC. The Centre is undertaking technological characterization of bauxite samples for establishing the mass balance of the process design.

S.N	Sponsoring agency	Title	Zero date Duration	Remarks / Outcomes
12.	International Bauxite, Alumina and Aluminium Society IBAAS, Nagpur	P-59: Technical feasibility study for extraction of alumina as Al ₂ O ₃ from low grade bauxite	(Mar 2019) 1 yr	A lab scale study has been undertaken for extraction of alumina as aluminium fluoride from low grade bauxite.
13.	Dept of Science and Technology (DST)	P-60: Development of a process technology (at lab scale) for low cost production of 3N (99.9%) pure alumina	(Mar 2019) 1½ yrs	Objective of the project is to develop the process know how for the low-cost production of 3N pure alumina suitable for LED (Light Emitting Diode) and Semiconductor applications. Challenge is to get the required product at much low temperature. Study of cost economics for 3N pure alumina synthesis process will also be evolved.

Collaborative work

JNARDDC is collaborating with the following agencies for various R&D projects of mutual interest and for the overall interest of the nation.

- i) **TAL Manufacturing Solutions Limited, MIHAN, Nagpur** : TAL a 100% subsidiary of TATA Motors and is one of the leading companies in Indian Automotive and Heavy Engineering and more recently, to Aerospace and Defence sectors. JNARDDC provided its technical expertise and support to TAL in overcoming the difficulties faced by them in addressing the heat treatment related issues for some of the critical alloy components. JNARDDC support to TAL will assist in meeting the needs of the growing aerospace industry in SEZ MIHAN, Nagpur and other parts of the country.
- ii) **Technology Information, Forecasting and Assessment Council (TIFAC), Department of Science and Technology, New Delhi and JNARDDC, Nagpur** joined hands to prepare a “Technology Road map – From Insights to Actions” covering the area of bauxite which is the prime raw material with potential from the perspective of energy, climate change, value addition and exports. The report prepared by JNARDDC and DST on “Bauxite-Status, Challenges, Opportunities & Road Ahead” was released in Oct 2018 along with other four sectors in presence of NITI Aayog officials.
- iii) **Maharashtra Remote Sensing & Application Centre (MRSAC) / Geological Survey of India (GSI), Nagpur**: JNARDDC successfully completed the joint project on “Large scale digital database creation of bauxite and laterite deposits using Geo-informatics technology for utilization by aluminium industries (with MRSAC, Nagpur and GSI, Kolkata). A one day capacity building programme on “Geo-informatics Technology” was organized by Maharashtra Remote Sensing Application Centre (MRSAC) in August 2018 at JNARDDC, Nagpur to impart necessary skill sets to the officials of JNARDDC and GSI for utilising the advance geospatial technology. The use of Remote Sensing Technology and its relevance in geo-mapping and creation of database for prospective miners was highlighted.
- iv) **Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India** Ministry of Power has renewed the nomination of JNARDDC as a sector expert for the aluminium sector under the PAT-2 /PAT-3 (Perform, Achieve & Trade) Scheme in the National Mission for Enhanced Energy Efficiency (NMEEE) under Climate Change Project. Director, JNARDDC has been nominated as the Chairman, Task force of aluminium sector. Services of JNARDDC are utilized by BEE as a sector expert for evaluation of energy audit reports of Indian aluminium industries for evaluation of energy audit reports of Indian aluminium industries and setting up normalisation patterns for evaluating the performance of industries in terms of energy efficiency.

- v) **DST and Indian Rare Earths Limited, IREL, Chattarpur, Odisha:** The Institute is collaborating with Indian Rare Earths Limited, for “Extraction of REEs from Red Mud” under the DST sponsored project.
- vi) **Christ University, Bangalore:** In order to strengthen the bond between R&D and academics JNARDDC is executing a joint project with Christ University titled Fabrication of Advanced Ceramic Nano-coatings for Automotive Applications.
- vii) **HINDALCO, Hirakud and Lapanga :** JNARDDC is the final stage of technical discussion with HINDALCO, Hirakud for setting up a Spent Pot Lining (SPL) Treatment plant of 5 TPD capacity having kiln equipped with induction heating. The SPL Treatment Plant shall provide a viable solution for treatment of harmful SPL generated as a bauxite residue. In a project awarded by HINDALCO, 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) 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.
- viii) **Geological Survey of India (GSI), Kolkata and Price Waterhouse Coppers Pvt Ltd (PWC) :** The institute shall be providing key inputs 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 program is aimed at increasing contribution of mining sector to GDP and reduced mineral imports.
- ix) **NITI AAYOG :** JNARDDC was entrusted with the responsibility of 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. 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.
- x) **Bureau of Indian Standard (BIS):** BIS has formed a 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. The 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).

- xi) **Carborundum Universal Limited (CUMI):** CUMI 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 shall be taking up the assignment.
- xii) **MOU with CETI (Consultancy Engineering & Training Institute) Gurgaon :** The firm signed an MOU for offering host of technical services to existing alumina refineries and technological and basic engineering packages to forthcoming projects in the areas of refractory grade calcined bauxite, specialty grade hydrate and alumina, vanadium sludge etc in India & abroad. This partnership will strengthen the hand of JNARDDC in design and engineering area.
- xiii) **MOU with Imerys, India (A JV unit of Imerys, France):** 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;
- xiv) **MOU with Sterling Educational Systems, Nagpur :** SES, Nagpur will be the engineering partner for supply of complete package to prospective investors desirous of setting up of SPL treatment plants ranging from 5 TPD to 50 TPD capacity.
- xv) **MOU with Anant Resources Limited, Sierra Leone.** The firm is 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. Anant Resources Ltd shall utilize the services of JNARDDC to thoroughly characterize bauxite and subsequently other mineral ores.
- xvi) **MOU with MRAI (Material Recycling Association of India):** JNARDDC is collaborating with MRAI for execution of joint project proposal “Techno-economic Survey of Aluminium Scrap Recycling in India”. A strategy shall be 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 report will assist the Government in formulating policies for the sector.
- xvii) **Central Institute of Plastics Engineering & Technology CIPET:** CIPET and JNARDDC initiated a joint project titled “To study the fire retardancy of nano-ATH in polymers” sponsored by S&T (Mines). Project envisages 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-tri-hydroxide and polymer matrix which shall be used for the electrical and other cable industries.

- xviii) **European Union – Resource Efficiency Initiative (EU – REI)** : As part of the European Union – Resource Efficiency Initiative (EU – REI) funded by the European Commission, a project consortium comprised of GIZ, adelphi, TERI and CII are providing technical assistance to the Indian resource efficiency initiative. This is done through, amongst other activities, exposure tours to European countries. A second exposure tour took place in Germany and Belgium from 20th to 28th February 2019, back to back with this year’s World Resources Forum in Antwerp. The tour targets Indian policy makers and stakeholders from MoEF& CC, TERI, Niti Aayog, JNARDDC and SRTMI who are currently contributing towards the formulation of a national Indian resource efficiency (RE) policy. The programme sought to provide insights into the preparation and application of policy instruments that promote RE and CE at different levels (national, federal and regional) in the European context. The exposure tour fostered mutual exchange and dialogue on sectoral learnings, thus opening the opportunity to deepen collaboration between India and the EU in the area of resource efficiency and circular economy.


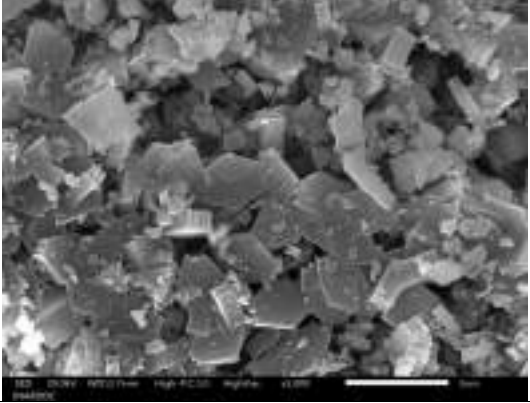



Director, JNARDDC In discussion with Environment Minister, Belgium

- xix) **IIT, Bhubaneswar** : DST has sanctioned a project “Development of a process technology (at lab scale) for low cost production of 3N (99.9%) pure alumina” which shall be executed in collaboration with IIT-Bhubaneswar. The earlier joint project titled Estimation of Morphodynamicity and its remedial action using Red-mud based concrete at coastal zone of Eastern Odisha has been successfully completed.
- xx) **VNIT, Nagpur** : JNARDDC has collaborated with VNIT, Nagpur and successfully completed the project - namely Developing downstream application of strip cast aluminium alloys (AA8011 and AA3004). Another project on nano processing of industrial rejects for use as additives in Mix-designs for improved pozzolanic reaction efficiency is under execution.

Patents

The following final patent applications were filed under the Patents Act, 1970 for various indigenous R&D process developed by JNARDDC under various research projects.

Sn	Details of Filing	Title of Patent
1.	<p>201821024434 dated 30.06.2018</p> <p>Dr. Md. Najar P A & team</p>	<p>A process for rapid analysis of reactive silica in bauxite and laterite based on selective autogenous dissolution at ambient temperature</p> <p style="text-align: center;">Selective leaching of SiO₂ at room temperature</p> 
2.	<p>201821049247 dated 27.12.2018</p> <p>Dr. Suchita Rai & team</p>	<p>A process for preparing smelter grade alumina</p> 
3.	<p>201921008361 dated 04.03.2019</p> <p>Dr P G Bhukte & team</p>	<p>A process for removal of iron oxide, silica and enrichment of alumina in ferruginous, siliceous and aluminous laterite by physical separation process</p> 

Technical Papers Presented / Published & Conferences

Journals :

1. *Microstructure and texture development during deformation and recrystallisation in strip cast AA8011 aluminium alloy, Ranjeet Kumar, Aman Gupta, Amit Kumar, R N Chouhan, Rajesh K. Khatirkar; Journal of Alloys and Compounds, 742, 369-382, April 2018.*
2. *Mathematical model for estimating variation in specific energy consumption with respect to capacity utilization for aluminium smelting plant, V K Jha, A Agnihotri, R J Sharma, M J Chaddha; Springer, Energy Efficiency, 11 (3), 773-776, 2018.*
3. *A simplified approach for generation of bearing curve by velocity distribution and press validation for aluminium extruded profile, VNSUV Ammu, P Mahendiran, Anupam Agnihotri, Samrat Ambade, P R Dungore; The International Journal of Advanced Manufacturing Technology, Vol- 98(5-8), 1733-1744, Sept 2018.*
4. *Preparation of Fe/Ti/Al nano-particles and mixed nano-composites from aluminium industrial wastes, Priyanka Nayar, Mohamed Najar, Prajakta Ogale, Shama Wadsariya, Suresh Puttewar and Anupam Agnihotri; Journal of Electronic Design Technology, 9 (2), 24-29, 2018.*
5. *Quantitative determination of metals in waste aluminium dross, Upendra Singh, M S Ansari, S A Thawrani, D R Meshram, S P Puttewar, A Agnihotri; Journal of Applied Chemistry, 11 (9), 1-4, 2018.*
6. *Studies on physical beneficiation & characterization for extraction of rare earths from bauxite residue, Upendra Singh, Sonali Thawrani, M S Ansari, Mayur Tirpude, S P Puttewar, Anupam Agnihotri; Metal Asia Magazine, 7, 124, July 2018.*
7. *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), Oct 2018.*
8. *Development of Super Thermal Resistant Al-Zr Alloy for Overhead Transmission Lines, R N Chouhan, A Agnihotri, MRAI Journal, MATERIAL RECYCLING Feb 2019; 1(1), pp 62*

Conference Proceedings.

9. *प्रविण भुक्ते, मोहमद नजर, सुरेश पुट्टेवार, अनुपम अग्निहोत्री; मूल्यवर्धित उत्पाद के लिए बॉक्साइट खान की अपव्ययी के प्रसंस्करण; अखिल भारतीय राजभाषातकनीकी सेमिनार; भारतीय खान बुरों, नाग पुर (अप्रैल १९, २०१९)*

DST-TIFAC Meet, Nagpur (April 2018)

10. *Status of Lateritic Bauxite deposits: possibilities for up gradation: Pravin G Bhukte; Brainstorming Session on "Opportunities & Potential of value addition in Bauxite: Technical Needs, Requirement and Way Forward" DST-TIFAC & JNARDDC, April 09, 2018*
11. *Development of value added products from un utilized materials (Bauxite Mine): Pravin G Bhukte; Brainstorming Session on "Opportunities & Potential of value addition in Bauxite: Technical Needs, Requirement and Way Forward" DST-TIFAC & JNARDDC, April 09, 2018*

BR2018, Athens, Greece, May 2018

12. Innovative process for extraction of iron values from east coast bauxite residue with gainful application of non-iron materials; S K Biswal, B K Sathpathy, A Agnihotri, D P Chakravarthy; 2nd Bauxite Residue Valorisation and Best Practices Conference (BR2018), Athens, Greece, May 7-10, 2018

Conference on “Advancement of Refractory Application in Aluminium Industries, VEDANTA (June 2018)

13. Aluminium dross: A suitable material for refractory application : Upendra Singh, M S Ansari, SonaliThawrani, MayurTirpude, AnupamAgnihotri; Conference on “Advancement of Refractory Application in Aluminium Industries” Vedanta, Jharsuguda June 21-22, 2018
14. Processing of low grade materials for refractory application: Pravin G Bhukte S P Puttewar, and A Agnihotri, Conference on “Advancement of Refractory Application in Aluminium Industries” Vedanta, Jharsuguda June 21-22, 2018

ICNFMM-2018, Ranchi (July 2018)

15. PAT scheme normalization factors for Indian aluminium smelter plants, A Agnihotri, V K Jha, & R J Sharma, at 22nd International Conference on Non-ferrous Minerals & Metals (ICNFMM-2018), Ranchi, 6-7 July, 2018.
16. Beneficiation & characterization of rare earths from red mud, Upendra Singh, SonaliThawrani, M S Ansari, MayurTirpude, S P Puttewar, AnupamAgnihotri; 22nd International Conference on Non-ferrous Minerals & Metals (ICNFMM-2018), Ranchi, 6-7 July, 2018.
17. Studies on Physical Beneficiation & Characterization for Extraction of Rare Earths from Bauxite Residue :DrUpendra Singh, 22nd International Conference on Nonferrous Minerals and Metals (ICNFMM-2018), Ranch, 6-7 July, 2018.

Conference on Extrusion Dies and Tooling, Pune (July 2018)

18. The effects of split ratio on extrusion pressure in a generic tube profile of AA6063 using porthole dies by numerical simulation V.N.S.U.Viswanath Ammu, P.Mahendiran, PirozeDungore, R.N.Chouhan, SamratAmbade in One day Conference on Extrusion Dies and Tooling at Pune 25th July 2018 by Aluminium Extruder’s Council of India

IBAAS-2018, Mumbai (Sept 2018)

19. Energy Consumption in Aluminium Electrolysis & Perform, Achieve & Trade (PAT), A Agnihotri & V K Jha at 7th International Bauxite, Alumina & Aluminium Conference & Exhibition (IBAAS), Mumbai, 5-7 September, 2018
20. Pre-concentration & extraction of strategic rare earths from Indian red mud, Upendra Singh, SonaliThawrani, B R Mishra, AnupamAgnihotri; 7th International Bauxite, Alumina & Aluminium Conference & Exhibition (IBAAS), Mumbai, 5-7 September, 2018.
21. Effect of seed properties on liquor productivity & product quality in precipitation process for development of special products, SuchitaRai, M J Chaddha, M T Nimje, R J Sharma, K J Kulkarni, Megha Panchal, SwetaModak, Vicky Dhongde and A. Agnihotri; 7th International Bauxite, Alumina & Aluminium Conference & Exhibition (IBAAS), Mumbai, 5-7 September, 2018.
22. Significance of geo-informatics technology in the evaluation of lateritic bauxite deposits” P G Bhukte, A S Deshpande, A Agnihori, S N Das, PremBabu, S P Puttewar, M J Chaddha, G T Daware, S Y Bhange, V M Kale; 7th International Bauxite, Alumina & Aluminium Conference & Exhibition (IBAAS), Mumbai, 5-7 September, 2018

23. Die design for generic tube profile using port hole die" V.N.S.U.ViswanathAmmu, P.Mahendiran, PirozeDungore, R.N.Chouhan, SamratAmbade: 7th International Bauxite, Alumina &Aluminium Conference & Exhibition (IBAAS), Mumbai, 5-7 September, 2018
24. "R&D Activities at JNARDDC for Utilization of Aluminium Industry Wastes, IBAAS, 2018" : M T Nimje, M J Chaddha, Mohamed Najar, SuchitaRai, Upendra Singh, S U Bagde, SnehaDwivedi, Priyansh Singh, AnupamAgnihotri : 7th International Bauxite, Alumina &Aluminium Conference & Exhibition (IBAAS), Mumbai, 5-7 September, 2018
25. Indian Technology Road Map for Aluminium: Vision 2030, AnupamAgnihotri; 7th International Bauxite, Alumina &Aluminium Conference & Exhibition, Mumbai, 5-7 September 2018.
26. Microstructural Characteristics of Strip Cast Aluminium Alloys, R.N. Chouhan, P.Dungore, and Rajesh Khatirkar(VNIT), 7th International Bauxite, Alumina &Aluminium Conference & Exhibition, Mumbai, 5-7 September 2018.
27. Process for potential utilization of bauxite residue for extraction of rare earths, Upendra Singh, B R Mishra &AnupamAgnihotri; International Conference on Science, Technology and Application of Rare Earths (ICSTAR), Tirupati, 23-25 September, 2018.

1st HINDALCO Alumina Conference 2018 (Oct 2018)

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

(ICONSEA-2018), JNTU, Hyderabad, (Oct 2018)

29. 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, SnehaDwivedi, PriyankaNayar, Suresh Puttewar and AnupamAgnihotri; 2ndInternational Conference on NanoScience and Engineering Applications (ICONSEA-2018), JNTU, Hyderabad, 4-6 October, 2018.
30. Comparative study of phase transformation of Al₂O₃ nanoparticles prepared by chemical precipitation and sol-gel auto combustion methods, PriyankaNayar, SayaliWaghmare, PriyanshSingh, MohamedNajar, Suresh Puttewar and AnupamAgnihotri; 2ndInternational Conference on NanoScience and Engineering Applications (ICONSEA-2018), JNTU, Hyderabad, 4-6 October, 2018
31. A viable process for recovery and value addition of mineral values: Preparation of calcium nanoparticles from industrial rejects, SayaliWaghmare, Priyansh Singh, PriyankaNayar, Mohamed Najar, Suresh Puttewar and AnupamAgnihotri; 2nd International Conference on Nanoscience and Engineering Applications (ICONSEA-2018), JNTU, Hyderabad, 4-6 October, 2018

GREEN ASHCON-2019 (Jan 2019)

32. Recovery of silica from Coal Fly Ash (CFA), International conference on Technological developments on fly ash utilization, M. T. Nimje MT, Rai SB, Jha VK, Bagde SU, Agnihotri A (2019). GREEN ASHCON- 2019, 11th-13th Jan. 2019 at Nagpur, India.

INCAL-2109, Bhubaneswar (Jan-Feb 2019)

33. Innovative process for boehmite precipitation in Bayer circuit, Rai SB, Chaddha MJ, Kulkarni KJ, Nimje MT, Rao KR, Mahendiran P, Sharma RJ, Agnihotri A (2019). 7thInternational Conference & exhibition on Aluminium, INCAL-2019, 31stJan. -3rd Feb. 2019 at Bhubaneshwar. (Poster presentation)

34. *Disposal practices and utilization of red mud: a review in Indian context and abroad, Rai SB, Bahadure S, Chaddha MJ, Agnihotri A; 7thInternational Conference & exhibition on Aluminium, INCAL-2019, 31stJan. -3rd Feb. 2019 at Bhubaneshwar. (Poster presentation)*
35. *Value-Added Geopolymer Products to Offset Expenditure on Waste Management and Sustainability, Mohamed Najar*, VishakhaSakhare, ShamaWadsariya, Numanuddin Azad, SnehaDwivedi, Amrita Karn, PravinBhukte, Suresh Puttewar And AnupamAgnihotri, 7thInternational Conference & exhibition on Aluminium, INCAL-2019, 31stJan. -3rd Feb. 2019 at Bhubaneshwar.*
36. *Stabilised red mud bricks: JNARDDC experience, M.J.Chaddha, R.J.Sharma1, Dr. S. B. Rai, K.J.Kulkarni, Dr. B.K. Satpathy at 7thInternational Conference & exhibition on Aluminium, INCAL-2019, 31stJan. -3rd Feb. 2019 at Bhubaneshwar..*
37. *Design of Port hole dies and weld strength criteria in aluminium extrusion. V.N.S.U.ViswanathAmmu, P.Mahendiran, PirozeDungore, R.N.Chouhan, SamratAmbad 7thInternational Conference & exhibition on Aluminium, INCAL-2019, 31stJan. - 3rd Feb. 2019 at Bhubaneshwar.*
38. *Preparation of 3N Pure Alpha Nano-Alumina at Low Temperature, PriyankaNayar, SayaliWaghmare, Mohamed Najar, MukeshChaddha, Upendra Singh, Suresh Puttewar, AnupamAgnihotri; 7thInternational Conference & exhibition on Aluminium, INCAL-2019, 31stJan. -3rd Feb. 2019 at Bhubaneshwar.*
39. *Development of Super Thermal Resistant Al-Zr Alloy for Overhead Transmission Lines, 7thInternational Conference & exhibition on Aluminium, INCAL-2019, 31stJan. -3rd Feb. 2019 at Bhubaneshwar.*

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.*
2. *4th Industrial Revolution, Anupam Agnihotri; National Workshop on “Research Methodology and Techniques for Engineering Technology and Management” (RMTETM-2018), Vellore Institute of Technology, Bhopal, 16-18 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 and Recent Advances in CO2 Capture Technology and its Sectoral Applications,, Anupam Agnihotri; Workshop on Awareness and Capacity Building in Carbon Capture, Storage and Utilization: Climate Change & Research Institute, New Delhi, 31 August 2018.*
5. *Lecture on aluminum extraction process and application: Hindu Mulinchi Shala, Mahal, Nagpur: Md Najar and RN Chouhan, 8th September 2018.*



6. *Future of Aluminium Technology, Anupam Agnihotri; 72nd Annual Technical Meeting of the IIM, IIM Jamshedpur, Kolkata, Kharagpur Chapters, Kolkata, 14-16 November 2018.*
7. *Paper Writing: Why and How?, Suchita B Rai, Research Conception, Techniques and Publication (with hands on) RCTP-2018, VNIT Nagpur, 17-21 December 2018.*
8. *Rare Earth Elements in Bauxite Residue (Red Mud): A Novel Untapped Indian Resource, Anupam Agnihotri; International Conference on Science, Technology & Applications of Rare Earths, ICSTASR-2018, Tirupati.*
9. *Importance of Basic Science for Technology, JN College Wadi Nagpur, Md Najar and RN Chouhan: Feb 2019*
10. *Aluminium in Circular Economy, Anupam Agnihotri; 7th International Conference & Exhibition on Aluminium, Bhubaneswar, 31st Jan- 3rd Feb, 2019.*
11. *Why Aluminium Recycling ?, Anupam Agnihotri; 6th MRAI International Indian Material Recycling Conference, Kochi, Kerala, 3-4 February, 2019.*

Academic Events

1. **"Opportunities & Potential of Value Addition in Bauxite: Technical Needs, Requirement and Way Forward, April 2018"** organized by JNARDDC and Technology Information, Forecasting and Assessment Council (TIFAC), Department of Science and Technology, Govt. of India at JNARDDC, Nagpur, 9th Apr 2018



JNARDDC, Nagpur and Technology Information, Forecasting and Assessment Council (TIFAC), Department of Science and Technology, Govt. of India organized brainstorming session on "Opportunities & Potential of Value Addition in Bauxite: Technical Needs, Requirement and Way Forward" on 9th April, 2018 at JNARDDC, Nagpur. Issues discussed covered status on production of bauxite, utilization of low grade ore, use of bauxite as value addition in various industries, development of new products, export of bauxite, etc. These discussions were very fruitful and will help in identifying areas for technology infusion and chalking out a technology interventions action plan/road map with a view to boost value addition and specialized use etc. Participants included stakeholders, representatives from Industries, Domain Ministries/Departments, Organizations, Institutes, Agencies, Bauxite Mine owners and experts in the respective areas .

In the next phase a symposium on "Technology Roadmapping –From Insights to Actions" was organized by DST, (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. The report prepared by JNARDDC and DST on "Bauxite-Status, Challenges, Opportunities & Road Ahead" was also released during the symposium in the presence of eminent personalities viz Dr Anil Kakodkar, Chairman TIFAC, Dr VK Saraswat, Member, NITI Aayog, Prof Ashutosh Sharma, Secretary DST and Dr A R Sihag, Secretary.

2. Workshop on Electron Microscopy (WEM-2018) at JNARDDC, Nagpur. April 2018



JNARDDC organized a workshop on Electron Microscopy (WEM-2018) during 19-21 April, 2018. First two days of the workshop were dedicated for young personnel from academic institutions, research organizations and industry while last day was dedicated to school/college students. This unique workshop aimed at disseminating the importance of the Electron Microscope which is used to investigate the microstructure of a wide range of biological and inorganic

specimens including microorganisms, cells, large molecules, biopsy samples, metals, and crystals. Industrially, the electron microscope is often used for quality control and failure analysis. Around 60 delegates from industry, academia and research labs participated in the programs who were thoroughly enlightened about various aspects of scanning electron microscopy and its applications.

On the last day (reserved exclusively for students) large number of students from different schools who participated were explained in detail about the working principles of scanning electron microscope and it's applications in minerals, materials, metal, biological and medical field. SEM functioning was also demonstrated and interactive quiz was arranged to ensure and gauge the enlightenment which was impressive.



3. 7th International Conference & Exhibition (IBAAS-2018) in Mumbai, Sept, 2018



IBAAS and JNARDDC in association with Aluminium Association of India (AAI) and The Indian Institute of Metals (IIM) organized 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 (~ 220 participants) and presentation of about 75 technical papers covering complete value chain from bauxite to aluminium downstream products.

4. Aluminium Network Meet (ANM-2018) organized by JNARDDC and Ministry of Mines at New Delhi, Oct 2018



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 wide spread participation (about 70 participants) from various organizations which included all primary

aluminium producers, secondary aluminium processors, bauxite mine owners, aluminium related industries, MRAI, FIMI FICCI, BEE, CPCB, Consultants etc. MOUs were signed with various organization to further strengthen the relationship and augment the research in the relevant field. JNARDDC also showcased the various products developed at the Centre for commercialization.



Four MOUs were signed with following organizations:



capacity.

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



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.

5. 7th International Conference on Aluminium and Exhibition (INCAL-2019) in Bhubaneswar, Odisha, Jan-Feb 2019.



JNARDDC participated as one of the key knowledge partner in organizing 7th International Conference & exhibition on Aluminium (INCAL-2019) held at Bhubaneswar from 31st Jan - 3rd Feb. This conference provided a perfect platform to exchange ideas on latest technological advances, discover novel opportunities, extensive networking, growth potential opportunities and challenges ahead etc. JNARDDC organized a day-long session on red mud disposal and utilization at the conference on 2nd Feb. 2019. Following papers from JNARDDC were presented at the conference:

- Value added geopolymer products to offset expenditure on waste management and sustainability
- Stabilized red mud bricks: JNARDDC experience
- Disposal practices and utilization of red mud: a review in Indian context and abroad
- Preparation of 3N pure alpha nano alumina at low temperature
- Design of port hole dies and weld strength criteria in aluminium extrusion
- Development of super thermal; resistant Al-Zr alloy for overhead transmission lines

6. Training program on aluminium technology for 3 batches of NALCO, smelter operators: February, 2019.



Training programs

Summer training for Engineering students at JNARDDC

Students from Visvesvaraya National Institute of Technology (VNIT, Nagpur) and Priyadarshini Institute of Engineering and Technology were offered summer orientation training covering areas right from bauxite to aluminium downstream processing. The training imparted will come handy to those students who wish to pursue career in aluminium industry.



One Day Capacity Building Programme on “Geo-informatics Technology”

The program 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. 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.

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.



MGS Training program at Salter Cyclone, Cheltenham, UK :

JNARDDC officials visited Salter Cyclone, Cheltenham, UK for knowledge sharing program on beneficiation techniques with special emphasis on Multi gravity Separator (MGS) during May 14-18, 2018. The program was mainly focused on practical utilization of beneficiation techniques for mineral beneficiation and separation heavies / REEs from red mud to upgrade the waste for leaching and extraction. Mr Ian Denial imparted training and demonstration of equipment at Cornwall, UK.



Vigyan Bharti Forum



To spread scientific awareness among the young minds, interactions of students with scientific community and laboratory visits was arranged by JNARDDC and Vignan Bharti Nagpur.



Awards / Achievements

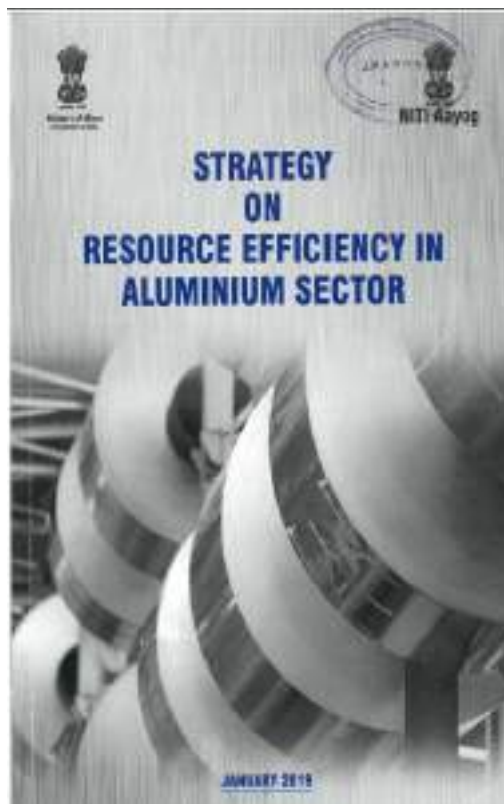
Scientific Excellence Award, 2018



During the 22nd International Conference on Non-Ferrous Mineral & Metals 2018 organized by Corporate Monitor during 6-7 July 2018 Director, JNARDDC was awarded with the Scientific Excellence Award 2018 at the hands of 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.

Strategy Paper on Resource Efficiency (RE) for NITI Aayog by JNARDDC



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. 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. The document prepared by JNARDDC and issued by NITI Aayog will open a new chapter in economywide mainstreaming of resource efficiency and circular economy in India

Best technical paper / presentation awards

- **Best Poster Presentation in 2nd International Conference on Nano-science & Engineering Applications (ICONSEA-2018) at JNTU, Hyderabad (4-6 October, 2018):** Paper Title: “Comparative study of phase transformation of Al₂O₃ nanoparticles prepared by chemical precipitation and sol-gel auto combustion methods was awarded to Dr Priyanka Nayar, Junior Scientist.



- **2nd prize for the best poster / presentation in IBAAS-2018** for ‘Effect of Seed Properties on Liquor Productivity & Product Quality in Precipitation Process for Development of Special Products’ in the 7th International Bauxite, Alumina and Aluminium Conference and Exhibition ‘IBAAS- 2018’ held at Mumbai, India, 5-7 September, 2018 was awarded to Dr Suchita B Rai, Principal Scientist.



Best paper in 2nd Bauxite Residue Valorisation and Best Practices Conference (BR2018), Athens



The paper on “Innovative process for extraction of iron values from east coast bauxite residue with gainful application of non-iron material” presented by Dr Anupam Agnihotri, Director, JNARDDC during 2nd Bauxite Residue Valorisation and Best Practices Conference (BR2018)” held in Athens,

Greece from May 7 -10, 2018 found place in best adjudged papers of the conference as well as for publication in prestigious Journal of Sustainable Metallurgy.

Best papers awards in INCAL-2019

Two best paper awards were awarded to JNARDDC for paper entitled “Preparation of 3N Pure Alpha Nano-Alumina at Low Temperature” and “Design of Porthole Dies and Weld Strength Criteria in Aluminium Extrusion” at “7th International Conference & Exhibition on Aluminium (INCAL-2019)” held on 31st Jan- 3rd Feb, 2019 at Bhubaneswar.



NABL Accreditation: JNARDDC has been granted the accreditation (9T-4561) by National Accreditation Board of Testing and Calibration Laboratories (NABL, New Delhi) in Jan 2019 vide certificate no.TC-8254. This will lead to further expansion of the testing and consultancy services.

Events 2018-19

17th and 18th PERC meeting at JNARDDC



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.

Similarly the 18th PERC meeting was also held on 24th Oct 2018 at JNARDDC. EA(Mines) also participated in the plantation program. The committee reviewed the various projects and recommended the shortlisted projects to SSAG for approval. The committee also reviewed six ongoing / completed projects of various institutions. JNARDDC provided the ideal location for the meeting with infrastructure accommodating 3 conference room and an auditorium for managing the entire meeting and project investigators.



International Yoga Day



JNARDDC and NIMH jointly organized International Yoga Day on 21st June, 2018 with great enthusiasm. On this occasion, eminent yoga trainer, Shri Shyam Deshpande from Janardan Swamy Yogabhyasi Mandal, Ram Nagar, Nagpur demonstrated different yoga-sanas and enlightened the participants about rich benefits of making yoga as

integral part of one's life which helps in effectively coping with stress and provides energy and vigour to think and perform for achieving success.

58th Meeting of the Central Geological Programming Board (CGPB)

The 58th Meeting of the Central Geological Programming Board (CGPB) was held on 15th February 2019 at the National Agricultural Science Centre (NASC) Complex, Indian



Council of Agriculture Research (ICAR), New Delhi. Shri Haribhai Parthibhai Chaudhary, Hon'ble Minister of State (Mines) graced the occasion as chief guest and inaugurated an exhibition displaying the status of "Mineral Exploration in India". The meeting was held under the chairmanship of Shri Anil Mukim, IAS, Secretary, Ministry of Mines, Govt. of India. Dr K Rajeswara Rao, IAS, Additional Secretary, MoM, Dr Dinesh Gupta, Director General, Geological Survey of India (GSI), Shri Bipul Pathak, IAS, Joint Secretary, MoM were the dignitaries to grace the meeting of the Board. JNARDDC participated in Exhibition to showcase Centre's achievements and valuable products/process developed from mine waste material.

Sector expert of Bureau of Indian Standard (BIS)



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. Steps have been envisaged to ensure that 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 and also taking in account the global practices and standards.

Vigilance Awareness

Hindustan Copper Limited and JNARDDC jointly hosted one day seminar on “Sharing of Best Practices in Vigilance” at JNARDDC on September 18, 2018 which was attended by Vigilance Officers of various organisations under Ministry of Mines and Coal. 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, NIMH etc.) shared their experiences in curbing corruption, in range of areas, employing suitable techniques.



JNARDDC & NIMH also organized the 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 in the presence of Director, JNARDDC.

Implementation of Right to Information Act, 2005



The Centre received 21 applications and there were no 1st and 2nd appeal under the RTI Act in the financial year 2018-19.

All of them were disposed off within the schedule time frame. The Centre is regularly updating the website with regards to RTI data.

SwachathaPakhwara



JNARDDC continued the zeal to implement the Swachh Bharat Abhiyan launched by Hon'ble Prime Minister Shri Narendra Modi. Swachatha pakhwara was observed during 16-18 Oct 2018 with a view to encourage the above program. JNARDDC was also a part of the plantation program launched by under the Green Maharashtra program by the State Govt.



Progressive use of Hindi



JNARDDC continued its efforts to promote the progressive use of Hindi. The Centre celebrated Hindi Pakwhada during 14th September to 1st Oct 2018 which included several competitions. Director, JNARDDC emphasized the need for further use of Hindi in day to day official use of the Centre's activities. Various renowned speakers grace the fortnight program

Science Expo



A Science Expo was organized at Raman Science Centre from January 16 to 20, 2019. The event was inaugurated by Dr Pramod M Padole, Director, VNIT Nagpur alongwith Dr Rakesh Kumar, Director NEERI, Nagpur. JNARDDC alongwith other fourteen renowned institutions participated in the Expo. During the expo, students and other visitors interacted with JNARDDC team and clarified various scientific queries and expressed gratification on knowledge exchange and update on aluminium and relevant areas.

हिंदी कार्यशाला का आयोजन

जवाहरलाल नेहरू एलुमिनियम अनुसन्धान विकास एवं अभिकल्प केन्द्र, नागपुर में हिंदी कार्यशाला का आयोजन दिनांक 27.06.2018 को किया गया. इस अवसर पर मुख्य अतिथि भाषा वैज्ञानिक डॉ सोमपाल सिंह द्वारा "कार्यालय में राजभाषा हिंदी में काम करते समय आने वाली कठिनायिया एवम निराकरण" के मुद्दे पर एक लेक्चर दिया.

Welfare for Persons with Disabilities, SC, ST and OBC.



The Centre is following the various government guidelines w.r.t PWD, SC& ST reservation. The Centre completed the recruitment process of persons with disability in Group- C/D category. The Institute is well equipped with wheel chairs and ramps with a view to make the office accessible to the specially disabled. Persons with disabilities actively participated in various programs such as Hindi week, sports day etc.

Deepak HPT 32 (Indian Air Force) IAF

The Indian Air Force (IAF) allotted one Deepak TTLE HPT-32 aircraft which is an Indian prop-driven primary trainer manufactured by Hindustan Aeronautics Limited. The same has been installed for display inside the office premises to propagate the importance of aluminium in aero-space applications.

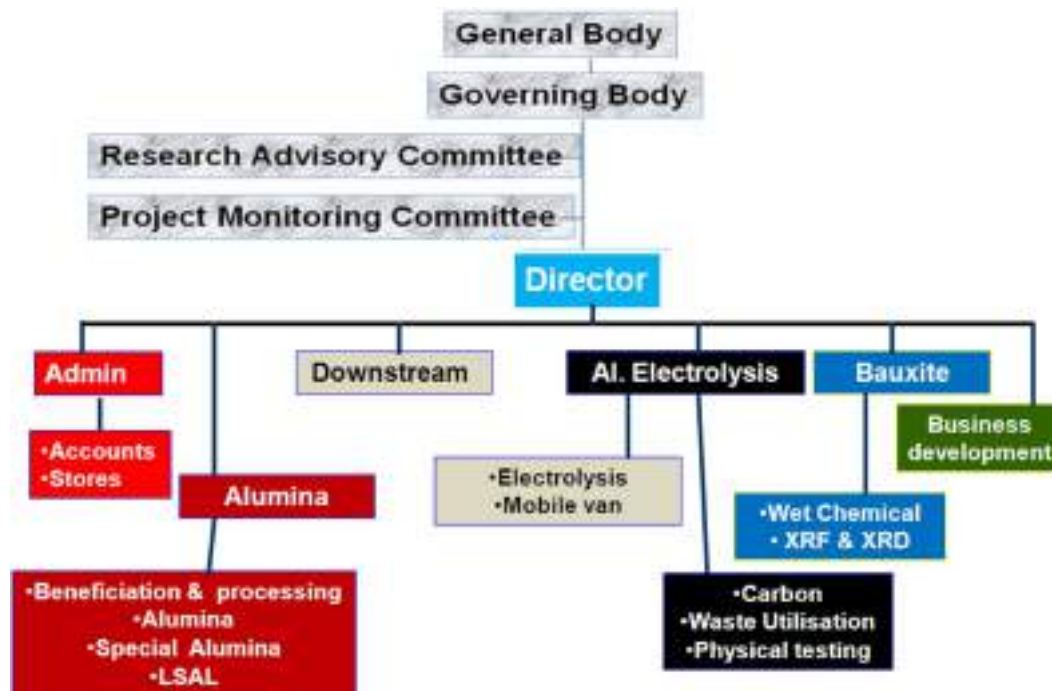


JNARDDC Organisational Chart : 2018-19



Shri Anil Gopishankar Mukim, IAS, Secretary to the Government of India, Ministry of Mines is the **Ex-officio chairman** of the **General Body** and **Governing Body** of JNARDDC. Dr. T K Chand, CMD, NALCO is the Ex-officio Deputy Chairman of JNARDDC. The other committees include the Research Advisory Committee (RAC) and Project Monitoring Committee (PMC) constituted by the Governing Body for monitoring R&D programs & projects of the Centre. The Centre is headed by the Director who is the principal executive officer.

The organization chart is as below:



Deputy Chairman
JNARDDC



Dr T K Chand
CMD, NALCO,
Bhubaneswar

Chairman
Research Advisory
Council (RAC)



Prof S P Mehrotra
IIT, Gandhinagar

Chairman
Project Monitoring
Committee (PMC)



Prof S Subramanian
IISc, Bangalore

Director
JNARDDC



Dr Anupam Agnihotri
JNARDDC, Nagpur

List of General Body Members: 2018-19

Chairman

Shri Anil Gopishankar Mukim, IAS
Secretary to the Government of India
Ministry of Mines, 3rd Floor, Shastri Bhavan
Dr. Rajendra Prasad Road, New Delhi - 110001

Members

1. Dr T K Chand Deputy Chairman, JNARDDC Chairman-cum-Managing Director National Aluminium Company Limited, NALCO Bhawan, P/1, Nayapalli Bhubaneswar - 751 013	7. Shri Satish Pai Managing Director HINDALCO Industries Limited Aditya Birla Centre B-Wing 3 rd Floor, S K Ahire Marg, Worli Mumbai – 400030
2. Prof. Ashutosh Sharma Secretary to the Govt of India, Department of Science & Technology Technology Bhavan, New Mehrauli Road New Delhi - 110 016	8. Shri Vikas Sharma Chief Executive Officer Bharat Aluminium Company Limited PO: BALCO Nagar KORBA – 495684 Chhattisgarh
3. Dr Girish Sahni Director General, CSIR Council of Scientific & Industrial Research Anusandhan Bhawan2, Rafi Marg New Delhi - 110 001	9. Shri Abhijit Pati President & COO VEDANTA Aluminium & Power Vill.: Bhurkamunda Jharsuguda – 768 202, Odisha
4. Dr K Rajeswara Rao, IAS Additional Secretary to the Govt. of India, Ministry of Mines, 3 rd Floor.ShastriBhavan New Delhi - 110001	10. Shri Atul Bhatt Chairman-Managing Director Metallurgical & Engineering Consultants (India) Limited, Doranda Ranchi - 834 002 (Jharkhand)
5. Ms Reena Sinha Puri, IAS Financial Advisor to Government of India Ministry of Mines Shastri Bhavan New Delhi - 110001	11. Shri Abhay Bakre Director General Bureau of Energy Efficiency Ministry of Power New Delhi.
6. Shri Alok Chandra Economic Adviser / JS to the Govt of India, Ministry of Mines 3 rd Floor, Shastri Bhavan New Delhi - 110001	12. Dr Anupam Agnihotri Director Jawaharlal Nehru Aluminium Research Development and Design Centre Amravati Road, Wadi Nagpur - 440 023

List of Governing Body Members: 2018-19

Chairman

Shri Anil Gopishankar Mukim, IAS
Secretary to the Government of India
Ministry of Mines, 3rd Floor, Shastri Bhawan
Dr. Rajendra Prasad Road, New Delhi - 110001

Members

- | | |
|--|--|
| <p>1. Dr T K Chand
Deputy Chairman, JNARDDC
Chairman-cum-Managing Director
National Aluminium Company Limited, NALCO
Bhawan, P/1, Nayapalli,
Bhubaneswar - 751 013</p> | <p>8. Shri Abhay Bakre
Director General
Bureau of Energy Efficiency
Ministry of Power
4th Floor Sewa Bhawan, Sector-1
RK Puram, New Delhi-110066</p> |
| <p>2. Dr K Rajeswara Rao, IAS
Additional Secretary to the Govt., of India
Ministry of Mines,
3rd Floor, Shastri Bhavan
New Delhi - 110001</p> | <p>9. Dr Vikas Kumar
Director
Defence Metallurgical Research
Laboratory, P.O. Kanchanbagh
Hyderabad - 500 058</p> |
| <p>3. Ms Reena Sinha Puri, IAS
Financial Advisor to Government of India
Ministry of Mines, 3rd Floor
Shastri Bhavan, New Delhi - 110001</p> | <p>10. Prof S P Mehrotra
Indian Institute of Technology
Gandhinagar, Palaj Campus, Gandhinagar
Ahmedabad – 382 424</p> |
| <p>4. Shri Alok Chandra
Economic Adviser / JS to the Govt. of India,
Ministry of Mines, 3rd Floor
Shastri Bhavan, New Delhi - 110001</p> | <p>11. Prof S Subramanian
Department of Materials Engineering
Indian Institute of Science
Bangalore – 560 012</p> |
| <p>5. Shri Vikas Sharma
Chief Executive Officer
Bharat Aluminium Company Limited
PO: BALCO Nagar
KORBA – 495684, Chhattisgarh</p> | <p>12. Shri Ajay Aggarwal
Scientist-E
Central Pollution Control Board
Parivesh Bhawan, East Arjun Nagar
Delhi – 110 032</p> |
| <p>6. Shri Satish Pai
Managing Director
HINDALCO Industries Limited
Aditya Birla Centre B-Wing, 3rd Floor,
S.K. Ahire Marg, Worli, Mumbai – 400030</p> | <p>13. Prof N S Vyas
Department of Mechanical Engineering
Indian Institute of Technology Kanpur
IIT, Kanpur.
Kanpur – 208 016</p> |
| <p>7. Shri Abhijit Pati
President & COO
VEDANTA Aluminium & Power
Vill. : Bhurkamunda, Jharsuguda – 768 202,
Odisha</p> | <p>14. Dr Anupam Agnihotri
Director
Jawaharlal Nehru Aluminium Research
Development and Design Centre
Amravati Road, Wadi, Nagpur - 440 023</p> |

List of Research Advisory Committee: 2018-19

Chairman

Prof. S.P. Mehrotra

Indian Institute of Technology, IIT Gandhinagar
Palaj Campus, Gandhinagar
Ahmedabad – 382 424 (Gujarat)

Members

- | | |
|---|--|
| <p>1. Shri Ravinder Gaur
Scientist-D / Advisor,
Department of Science & Technology,
Technology Bhavan, New Mehrauli Road,
New Delhi - 110 016</p> | <p>6. Shri Vikas Sharma
Chief Executive Officer
Bharat Aluminium Company Limited
PO : BALCO Nagar
KORBA – 495684, Chhattisgarh</p> |
| <p>2. Prof S Subramanian
Department of Materials Engineering
Indian Institute of Science
Bangalore – 560 012</p> | <p>7. Shri Satish Pai
Managing Director
HINDALCO Industries Limited
Aditya Birla Centre B-Wing
3rd Floor, S.K. AhireMarg, Worli
Mumbai – 400030</p> |
| <p>3. Shri K S Raju
Ex-CG, IBM, Plot No. 19, Pragati Layout
14th Cross, Bhuvaneshwari Nagar,
Kempapura, Hebbal Post,
Bangalore – 560 024</p> | <p>8. Dr B K Satpathy
Ex- General Manager (R&D), NALCO
Plot No. 803
JaydevVihar
Bhubaneswar - 751 013 Odisha</p> |
| <p>4. Shri S K Roy
Director (P&T)
National Aluminium Company Limited,
NALCO Bhawan,
P/1, Nayapalli,
Bhubaneswar - 751 013</p> | <p>9. Dr Anupam Agnihotri
Director
Jawaharlal Nehru Aluminium Research
Development and Design Centre (JNARDDC)
Amravati Road, Wadi, Nagpur - 440 023</p> |
| <p>5. Dr A K Mukhopadhyay
Outstanding Scientist
DRDO, Defence Metallurgical Research
Lab, PO : Kanchanbagh,
Hyderabad - 500 058</p> | |

List of Project Monitoring Committee: 2018-19

Chairman

Prof. S. Subramanian

Department of Materials Engineering
Indian Institute of Science (IISc), Bangalore – 560 012

Members

- | | |
|---|---|
| <p>1. Shri Ravinder Gaur
Scientist-D / Advisor, ,
Department of Science &
Technology, Technology
Bhavan, New Mehrauli Road,
New Delhi - 110 016</p> | <p>5. Dr. T.R. Ramachandran
Emeritus Scientist
Nonferrous Materials Technology
Development Centre (NFTDC)
P.O. Kanchanbagh
Hyderabad - 500 058 (AP)</p> |
| <p>2. Prof. D.R. Peshwe
Head, Department of
Metallurgical & Materials Engg.
VNIT, Nagpur – 440 010</p> | <p>6. Dr. B.K. Satpathy
Ex- General Manager (R&D), NALCO
Plot No. 803
JaydevVihar
Bhubaneswar - 751 013 Odisha</p> |
| <p>3. Shri S.K. Roy
Director (P&T)
National Aluminium Company
Limited, NALCO Bhawan,
P/1, Nayapalli,
Bhubaneswar - 751 013</p> | <p>7. Dr. Anupam Agnihotri,
Director,
Jawaharlal Nehru Aluminium Research
Development and Design Centre (JNARDDC)
Amravati Road, Wadi,
Nagpur - 440 023</p> |
| <p>4. Dr. A.K. Mukhopadhyay
Outstanding Scientist
DRDO, Defence Metallurgical
Research Lab, PO :
Kanchanbagh,
Hyderabad - 500 058</p> | |

Scientists and Staff as on 31.03.2019

Dr. Anupam Agnihotri, Director

Scientists : 20

Dr SP Puttewar	Sr Principal Scientist	Mr VNSU Viswanath Ammu	Senior Scientist
Mr M T Nimje	Sr Principal Scientist	Mr V K Jha	Senior Scientist
Mr M J Chaddha	Sr Principal Scientist	Mr P Mahendiran	Senior Scientist
Mr R J Sharma	Sr Principal Scientist	Dr Paparao Mondri	Scientist
Mr P R Dungore	Principal Scientist	Dr Priyanka Nayar	Junior Scientist
Dr Md Najar P A	Principal Scientist	Mr Ramavajjala Anil Kumar	Junior Scientist
Dr (Mrs) S Rai	Principal Scientist	Ms Prachiprava Pradhan	Junior Scientist
Dr P G Bhukte	Principal Scientist	Mr Kola Immanuel Raju	Junior Scientist
Mr R N Chouhan	Principal Scientist	Ms Jyoti G Pendam	Junior Scientist
Dr U Singh	Principal Scientist	Mr Anas N S	Junior Scientist

Scientific & Technical Supporting Staff : 17

Mr K R Rao	Sr Scientific Officer Gr-II	Mr S Bagde	Scientific Asst II
Mr S K Thokal	Sr Scientific Officer Gr-II	Mr Sandeep Kowe	Scientific Asst I
Ms K Janbandhu	Sr Scientific Officer Gr-II	Ms V Meshram	Technical Asst III
Mr N Warhadpande	Sr Scientific Officer Gr-I	Mr P Manthena	Technical Asst II
Mr K J Kulkarni	Sr Scientific Officer Gr-I	Mr K B Gour	Technical Asst II
Ms M Panchal	Scientific Asst IV	Mr V B Wankhede	Technical Asst II
Mr D R Meshram	Scientific Asst III	Mr V Kshirsaut	Technical Asst II
Mr A S Gijare	Scientific Asst III	Mr S Yadav	Technical Asst I
		Mr V P Naik	Technical Asst I

Administrative Staff : 9

Mr R Srinivasan	Sr Admin Officer	Ms R Tembhurne	Personal
Ms R Vishakha	Admin Officer	Mr N D Pethe	Secretary
Mr S R Barhanpurkar	Personnel Officer	Ms D Seshukumari	Personal Asst
Mr G Bhaskar	AAO (Accounts)	Mr K Kishore	Personal Asst
Mr R K Meshram	Personal Officer		Sr Accountant

Supporting Staff : 4

Mr Ashok J Hatwar	Driver-cum-Lab Attendant Sr Grade
Mr R C Patley	Driver-cum-Lab Attendant Sr Grade
Mr Raju Khobrgade	Driver-cum-Lab Attendant Grade- I
Mr Deochand S Thakare	Peon-cum-Messenger

Total Staff Strength: 51

New Equipments / facilities

Spin Coating Machine

Automatic Spin Coating System (EZspinA1) for the deposition of uniform thin film (of thickness of nanometers range) on varieties of flat substrates was procured. This system is equipped with an infra-red chamber heating module as well as ultra violet chamber curing model which is very useful for insitu heating as well as curing of the sample.



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 was installed 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.

High Energy Planetary Ball Mill



PULVERISETTE-5 Premium Line Planetary Ball Mill from FRITSCH, Germany was installed in JNARDDC. 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)



The institute 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.

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.

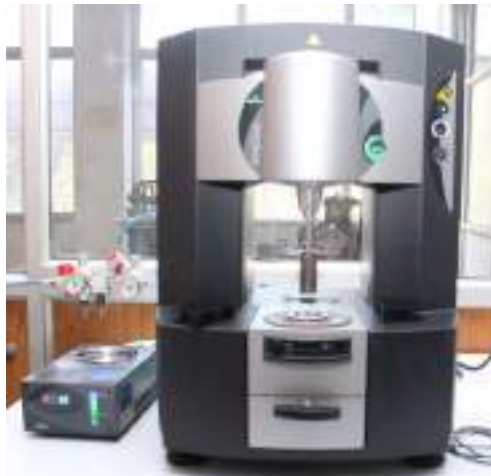
Multi-Gravity Separator (MGS)



JNARDDC has recently installed a Salter Cyclone Multi-Gravity Separator Model SCMG1 from UK. The MGS represents the latest development in physical beneficiation of fine grain mineral separation/upgrading of mineral values contained in

fine and ultra-fine particles. It is best suited for ultra-fine separation from 100 μm to 2 μm . This equipment will be very useful in path breaking studies, aimed at economically recovering rare earth elements from bauxite residue (red mud).

Inductively Coupled Plasma Mass Spectrometry (ICP-MS)



The NEXION 2000 ICP-MS allows determination of elements with atomic mass ranges 7 to 250 (Li to U). A single collector ICP-MS may use a multiplier in pulse counting mode to amplify very low signals, an attenuation grid or a multiplier in analogue mode to detect medium signals, and a Faraday cup/bucket to detect larger signals. A multi-collector ICP-MS may have more than one of any of these, normally Faraday buckets which are

much less expensive. With this combination, a dynamic range of 12 orders of magnitude, from 1 ppb to 100 ppm is possible.

The concentration of a sample can be determined through calibration with certified reference material such as single or multi-element reference standards. ICP-MS is useful for quantification of almost all elements in the following samples, Geochemical/Mining, Environmental, Food, Pharmaceutical Drug, Chemical/Industrial, Agriculture trace metals at ppb to ppt level.

ANNUAL ACCOUNTS

2018-19



Jawaharlal Nehru Aluminium Research Development & Design Centre
Autonomous Body under Ministry of Mines, Govt. of India
Amravati Road, Wadi, Nagpur – 440023
www.jnarddc.gov.in

CA.PURUSHOTTAM SAHU

B.Com., F.C.A.

**P. S. SAHU & CO.**

CHARTERED ACCOUNTANTS
OPP. ATTARWALA SHOP, NEAR LOHAPUL,
MAIN ROAD, SITABULDI,
NAGPUR-440012

PHONE : 9423616996, 9325599666

E-mail : purusahu_ngp@yahoo.co.in

REPORT OF AN AUDITOR RELATING TO ACCOUNTS AUDITED UNDER
 SUB-SECTION (2) OF SECTION 33 & 34 AND RULE 19 OF BOMBAY PUBLIC
 TRUST ACT.

Registration No. : F -6778 (NAGPUR)
 Name of Public Trust : **JAWAHARLAL NEHRU ALUMINIUM RESEARCH
 DEVELOPMENT AND DESIGN CENTRE : NAGPUR**
 (An Autonomous Body Under Ministry of Mines,GOI.)
 Amravati Road Wadi, Opp. Wadi police station Nagpur
 Post : Wadi (440 023)

For the year ending : **31st March 2019**

(a)	Whether accounts are maintained regularly and in accordance with the provisions of the Act and the rules	YES
(b)	Whether receipts and disbursements are properly and correctly shown in the accounts	YES
(c)	Whether the cash balance and voucher in the custody of the manager or trustee on the date of audit were in agreement with the account	YES
(d)	Whether all books, deeds, accounts, vouchers or other documents or record required by the auditor were produced before him	YES
(e)	Whether a register or movable and immovable properties is properly maintained, the changes therein are communicated from time to time to the regional office.and the defects and inaccuracies mentioned in the previous audit report have been duly complied with	YES
(f)	Whether the Manager or trustee or any other person required by the auditor to appear before him did so and furnished the necessary information required by him	YES
(g)	Whether any property or funds of the Trust were applied for any object or purpose other than the object or purpose of the Trust	NO
(h)	The amount of outstanding for more than one year	YES
(i)	The amounts written off if any	YES
(j)	Whether tenders / quotation were invited for repairs or construction involving expenditure exceeds Rs.25,000/-	YES
(k)	Whether any money of the public trust has been invested contrary to the provisions of Section 35	NO
(l)	Alienations. If any, of the immovable property contrary to the provisions of Section 36 which have come to the notice of the auditor	NIL

**JAWAHARLAL NEHRU ALUMINUM
RESEARCH DEVELOPMENT & DESIGN CENTRE**

2018-19

(m)	All cases of irregular, illegal or improper expenditure, or failure or omission to recovery moneys or other property belonging to the public trust or of loss or waste of money or other property thereof , and whether such expenditure, failure, omission , loss or waste was caused in consequence of breach or trust or misapplication or any other misconduct on the part of the trustees or any other person while in the management of the trust.	NIL
(n)	Whether the budget has been filed in form provided by rule 16-A	YES
(o)	Whether the maximum and minimum number of the trustees is maintained	YES
(p)	Whether the meeting are held regularly as provided in such instrument	YES
(q)	Whether the minute of books of the proceedings of the meeting is maintained	YES
(r)	Whether any of the trustees has any interest in the investment of the trustees	NO
(s)	Whether any of the trustees is a debtor or creditor of the trust	NO
(t)	Whether the irregularities pointed out by the auditors in the accounts of the previous year have duly complied with by the trustees during the period of audit	YES
(u)	Any special matter which the auditor may think fit or necessary to bring to the notice of the Deputy or Assistant Charity Commissioner	NO

**For P. S. SAHU & CO.
Chartered Accountants**

**Place : NAGPUR
Date :**

**CA PURUSHOTTAM SAHU
Proprietor
Mem No. : 129802
FRN : 129249W**

.2.

CA.PURUSHOTTAM SAHU

B.Com., F.C.A.

**P. S. SAHU & CO.**

CHARTERED ACCOUNTANTS
 OPP. ATTARWALA SHOP, NEAR LOHAPUL,
 MAIN ROAD, SITABULDI,
 NAGPUR-440012
 PHONE : 9423616996, 9325599666
 E-mail : purusahu_ngp@yahoo.co.in

THE BOMBAY PUBLIC TRUSTS ACT 1950
SCHEDULE IX C

Statement of income liable to contribution for the year ending 31st March 2019

**Name of Public Trust : Jawaharlal Nehru Aluminium Research Development
 and Design Centre Nagpur.**

Registration No. : F-6778 (NAGPUR)

		Rs.	Rs.
I	Income as shown in the Income and Expenditure Accounts (Schedule IX)		11,44,00,258/-
II	Items not chargeable to contribution under sec .58 and Rule 32 :		
	I.) Donations received from other Public Trusts and Dharmaday	NIL	
	ii) Grants Received from Government & Local Authorities	7,30,08,461	
	iii) Interest on Sinking or Depreciation Fund	NIL,	
	iv) Amount spent for the purpose of secular education	NIL	
	v) Amount spent for the purpose of Medical relief	NIL	
	vi) Amount spent for the purpose of veterinary treatment of Animals	NIL	
	vii) Expenditure incurred from donation for relief of distress Caused by scarcity, drought, flood, fire or other natural Calamity	NIL	
	viii) Deductions out of income from lands used for Agricultural purposes:	NIL	
	(a) Land Revenue local Fund Cess	NIL	
	(b) Rent Payable to superior land lord	NIL	
	(c) Cost of production, if lands are cultivated by Trustee	NIL	

**JAWAHARLAL NEHRU ALUMINIUM RESEARCH
DEVELOPMENT & DESIGN CENTRE ,NAGPUR**

(F Y : 2018-2019)

ix). Deductions out of income from lands used for non Agricultural purposes :	NIL	
(a) Assessment, Cesses and other Government or Municipal Taxes, Land tax etc	80620/-	
(b) Ground rent payable to the superior landlord	NIL	
(c) Insurance Premium	NIL	
(d) Repairs at 10 percent of gross rent of building	NIL	
(e) Cost of collection 4 percent of gross rent of building let out	Nil	
(x) Cost of collection of income or receipts from Securities, stocks etc. At 1 percent of such income	NIL	
(xi) Deductions on account of repairs in respect of building not rented and yielding no income at 10 percent of the estimated	NIL	
Gross Annual Income Chargeable to advance Contribution (Payable to Dy Charity Commissioner)		NIL

Certified that while claiming deductions admissible under the above schedule, the Trust has not claimed any amount twice, either wholly or partly, against any of the items mentioned in the Schedule which have the effect of double deductions.

For P. S. SAHU & CO.
Chartered Accountants

Place : NAGPUR
Date :

CA PURUSHOTTAM SAHU
Proprietor
Mem No. : 129802
FRN : 129249W

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
		SCHEDULE-A
RENT AND OTHER DEPOSITS		
Previous year	PARTICULARS	(Amt. in ₹)
9903556.93	Earnest Money Deposit	14059936
82689	Security Deposit :Rajesh S Badkhal	85194
92481	Security Deposit :Media Elevators & Engg Co.	193848
153942	Security Deposit : Mayur Services	119136
216508	Security Deposit : Ganga Security	490217
251694	Security Deposit : Bajaj Steel	602492
0	Security Deposit : SMS India Pvt Ltd	2950000
0	Security Deposit : Libra Agencies	200000
0	Security Deposit : Sameer Ghadge	356316
0	Security Deposit : Enkey Electricals Pvt ltd	1396723
10700870.93	Total-1	20453862
		SCHEDULE-B
SUNDRY CREDITORS / OTHER LIABILITIES		
Previous year	PARTICULARS	(Amt. in ₹)
25000	Audit Fee Payable	25000
3320895	Outstanding Liabilites (Annexure B-1)	5384219
4494	Anacon Laboratories	0
5000	Unitech (I) System &Services	5000
5900	Calderys India	8600
2003	Mantissa Project Pvt ltd	0
28710	Bhagwati Trading of Automobiles	28710
687	Western Metal Industries Pv Ltd	0
196089	Advance from Party	0
22000	Monarch Enterprises	0
268688	Advance Refrigeration Engg Pv Ltd	0
13800	Vedatna Aluminium Langigarh	84296
1365	C I M F R Nagpur	0
3450	Ashapura Minechem Ltd	0
160	Ramson Casting Pvt ltd	0
0	Emplyees EPF	6567
0	Sharp Control Equipment Pvt Ltd	21240
0	Libra Agencies	129719
0	Chennai Metco Pvt Ltd	15500
0	TDS GST Payable	121028
0	Castwel Industries	2950
0	MPM Pvt Ltd	16520
0	Graphic Paper Products Limited	4248
0	Tal Manufacturing solutions ltd	7660
0	Hind Aluminium Ltd Silvasa	2640
0	Carborundum Universal Ltd	5310
3898241	Total-2	5869207
15099112	GRAND TOTAL 1+2	26323069

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE -BAGPUR		
Annexure : B-1		
OUTSTANDING LIABILITIES AS ON 31/3/2019		
Previous year	PARTICULARS	(Amt. in ₹)
106898	Water charges bill	179813
0	Staff Medical bill	260445
165986	Rajesh S Badkhal for Gardening contract	166490
158484	Media Elevator co ltd for Elect contract	169260
20027	Telephone charges	0
0	Courier Charges	4056
330276	Mayur Service Housekeeping Contract	325355
315660	Electricity charges	464702
394177	Ganga Security services	490098
10000	Dr Sanjay Marathe	20000
722210	Salary Allowances(CEA)	54000
468000	Advance Regniration Engineering Pvt Ltd	0
424711	Vijayraj Enterprises	0
159466	Jog Hospitality Pvt Ltd	0
45000	Lalit Mohan	0
0	The Trust Group Gravity JNARDDC A/c	3250000
3320895	Total Outstanding Liabilities	5384219

ANNEXURE OF FIXED ASSETS ATTACHED TO & FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2019													
Particulars	Rate of Dep %	Cost as at 01.04.2018		Gross Block Divisions		Adjustments		Dep as at 31.03.2019		Depreciation		Net Block	
		Address	31.03.19	31.03.19	31.03.19	31.03.2019	31.03.2019	31.03.2019	31.03.2019	31.03.2019	31.03.2019	31.03.2019	31.03.2019
Inseparable properties													
Technical Buildings	3.34	51891795	0	0	51891795	46204992	1739523	0	0	42620915	0	9971600	11797613
Office Buildings	1.03	5644528	0	0	5644528	8916328	263226	0	0	8161554	0	8882971	9128197
Land	2615177	0	0	0	2615177	0	0	0	0	0	0	2615177	2615177
Fire Fighting System	4.75	1270962	0	0	1270962	1270962	0	0	0	1270962	0	0	0
Electrical Installation	3.34	21812367	0	0	21812367	16743824	728533	0	0	17472357	0	4246000	6088533
Basemental Buildings	1.03	31442316	0	0	31442316	19672874	512510	0	0	11185384	0	20269932	20719462
Large Scale Analysis Lab	4.75	8840295	0	0	8840295	4584276	539962	0	0	8924388	0	24927	356019
Air Conditioning	4.75	5640941	0	0	5640941	3691316	239720	0	0	3531048	0	1118853	1318623
Sub Total		137472388	0	0	137472388	85172774	3792514	0	0	88865388	0	47208950	60999604
Previous Year		134168992	330375	1599980	0	138172378	72817823	3792514	0	0	95172774	50999604	52748634
Movable Properties													
Motor Vehicles	11.31	5551487			5551487	4508438	627874	0	0	5136312	0	415185	1043059
Furniture and Fixtures	6.33	5146412	106816		5253227	5146412	109816	0	0	5253227	0	0.00	0
Office Equipments	4.75	2401781			2401781	2682270	114885	0	0	2172355	0	236426.00	342511
Telecommunication system	4.75	2621667			2621667	1494976	96029	0	0	1591045	0	43662.00	516691
Books and Periodicals	100	8180586	69927		8249512	8180586	69927	0	0	8249512	0	0.00	0
Lab Equipments Installed	4.75	123877710	8688815		132566525	102224266	6299910	0	0	108521116	0	24045408.55	21653504
Lab equip (SSAG Grant Grants)	4.75	11126812	3505843		14632655	4669942	694886	0	0	4763938	0	9885495.61	7057779
Lab Equip (Nako Capital grants)	4.75	19280319			19280319	607583	521325	0	0	6952088	0	12483311.00	13244526
Lab Equip (Molnoko)	4.75	19772746			19772746	7682464	89705	0	0	8574895	0	10198637.00	11090562
Lab equipment under one count	4.75	34532982	71266424		105799406	4423947	5024522	0	0	9448148	0	96331237	30198335
Lab equipment DST P.55	4.75	4460171			4460171	211868	211868	0	0	420718	0	4034455	4248213
Lab Equipments not Installed		0	4453963		4453963	0	0	0	0	0	0	4453963.00	0
Computers	16.21	6210562			6210562	6210562	0	0	0	6210562	0	0.00	0
Technical research equip (UNDP)	4.75	70484911	0		70484911	70484911	0	0	0	70484911	0	0.00	0
Sub Total		209163114	88667426		297830541	219769354	15054846	0	0	23462098	0	162409742	89397161
Previous Year		207800581	11272534		209163114	188631230	8202241	0	0	199831230	0	89397161	89191788
Grand Total		446635482	88667426	0	534702998	304838726	18647460	0	0	323786188	0	266018732	140396765

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
SCHEDULE : D - 1/2		
PRE YEAR	PARTICULARS	(Amt. in ₹)
	1) . SUNDRY DEBTORS	
3000	Balco Korba (Testing charges)	0
199420	Nalco, Bhubaneswar (Project)	3114886
389994.72	Energy Efficiency Services Limited Delhi (BEE)	290995
116669	Minex Metallurgical co Ltd	134813
1835316	M E C L Nagpur	594277
14821	NEERI	33446
2850	ACE Calderys Ltd	2850
30000	Seminar Microscopic Techniques(Balco)	0
10000	Seminar Extrusion (SDS Digital , Gurgaon)	0
666700	Sesa Sterlite Limited(Vedanta)	666700
292300	Swarnalata Holding Pvt ltd Raipur	292300
4248	Ceraflux India Pvt ltd	0
11500	Yes Environmental Services	11500
4070000	Ministry of Mines (AMDF Fund /Salary etc) receivable	14319000
814000	Red mud Status project (SSAG)	0
4971635	GSI Nagpur	130206
59000	Spectris Technologies Pvt Ltd	59000
88000	Vedanta Alu & Power Jharsugda SEZ	176000
2950	Star Pharma	0
15080	Tal Manufacturing Solutions Ltd Nagpur	0
983871	N I M H Nagpur	2450523
756024	Seminar Downstream 2018	200880
1599215	GST Credit balance	9879658
0	Ashapura Minechem Ltd	47200
0	Bry Air Asia Pvt ltd	103696
0	Gharda Chemicals Ltd Mumbai	9440
0	Nalco Anul Testing	185850
0	Thakkar Inorganics Pvt Ltd	1475
0	MMP Industries Limited Nagpur	11800
0	Zim Laboratories Ltd	30090
0	Vipra Cenosphere India Nagpur	2065
0	Hi Tech Matafluxes Raipur	472000
0	Ran Chemicals Pvt ltd	6608
0	Anand Mine Tools Pvt ltd	1180
0	Associated Aluminium Industries Ltd	2360
0	Phonix Amalgams Pvt Ltd	4720
0	Hindalco Industries Ltd Belgavi	17700
0	Bajrang Power & Ispat Ltd Raipur	860
0	Trshakti Alloys Pvt Ltd	12744
16936593	(Total ' 1 ')	33266822
	9	SCHEDULE-D(Contd...)

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
		SCHEDULE : D- 2/2
	2). INVENTORIES	
340017	STORES(Closing Stock)	90215
PRE YEAR	PARTICULARS	AMOUNT
630903	DEPARTMENTAL ADVANCES (Annexnure : D-3)	196083
PRE YEAR	PARTICULARS	Amount
109000	Telephone Deposit	109000
5000	INDOC New Delhi	0
315000	Deposit with MSEB	315000
1000	Deposit with Vimal Gas Agency	1000
102410	Deposit with M.S.Water Board	102410
1000	M/s Khurana Gases P. Ltd.	1000
5000	Deposit Speciality Gas Services	5000
9214545	TDS Amt receivables From I tax office	11576889
1250000	Prepaid Expenses	1500000
599535	Accrued Interest receivable from MSEB/SBI/IDBI	127494
5000	Deposit with CTO for ISD facility	0
8314	EMD deposit with O & N G C	0
29000	Receivable from NIMH	0
412836	Adv to Track Cargo Pvt Ltd Delhi	13997
17700000	Adv to SMS India Pvt Ltd	0
150000	Adv Century Extrusions Ltd Kharagpure	0
1173153	Adv Bajaj Steel (Mobilisation Adv)	0
0	Adv Active Cargo Solution Pvt Ltd	3986
0	Adv Shree Enterprises Nagpur	725000
0	Adv Sameer Ghadge	1505460
0	Deposit with MSEB for new Connection	1157603
31080792	(TOTAL-4)	17143839
48988305	GRAND TOTAL	50696958

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
ANNEXURE OF ADVANCES TO EMPLOYEES ATTACHED TO AND FORMING PART OF		
Annexure 'D-3' TO SCHEDULE : D : 2018-19		
		SCHEDULE D-3
PRE YEAR Amount	PARTICULARS	Current Year Amt
	1: DEPARTMENTAL ADVANCES- EMPLOYEES	(Amt in ₹)
8917	M.J.Chaddha	10279
5000	A.J.Hatwar	5000
5000	R.C. Patley	5000
10000	R.N.Chouhan	10000
15000	R. Srinivasan	5000
5000	Sandeep Barhanpurkar	5000
10000	M.T.Nimje	9620
5845	S.K.Thokal	5000
10000	S.P.Puttewar	10000
5000	Viswanath Ammu	36000
92000	Upendra Singh	25050
38096	Vimal Kishore Jha	2928
10200	K Kishore	0
15000	Dr Anupum Agnihotri	5000
15400	Dr P G Bhukte	24198
5000	R J Sharma	2988
8000	Sbhajeet Yadav	0
20020	Vinod Kshirsaut	5020
15000	Raju Khobragade	5000
14000	Vipin Naik	0
15000	TA Adv Project staff	0
30000	K B Gour	0
5000	R K Meshram	5000
147000	P R Dungor	0
45700	A S Gijare	0
45000	D R Meshram	5000
1025	Priyanka Nayar	0
15000	Rajasekhar Rao	10000
14700	N D Pethe	0
0	K J Kulkarni	5000
630903	Total	196083
	CASH AND BANK BALANCES	
		SCHEDULE E
PRE YEAR	PARTICULARS	AMOUNT
2971271	SBI Chhaoni Nagpur	2971271
40042712	I D B I Bank Ltd Nagpur	26237365
38560	Cash in Hand (Ref. Schedule VIII)	0
296923	Axis Bank Limited, Nagpur	2313427
29960092	YES Bank Saving account(764)	3031205
1535611	YES Bank Tax payment Account(901)	1535611
17380	YES Bank e-Tender Account (830)	17380
1136922	YES BANK DST A/c (624)	52949
0	IDBI Onlice A/c No (4688)	1138462
75999470	Total	37297670

CA.PURUSHOTTAM SAHU

B.Com., F.C.A.



P. S. SAHU & CO.
CHARTERED ACCOUNTANTS
OPP. ATTARWALA SHOP, NEAR LOHAPUL,
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NAGPUR-440012
PHONE : 9423616996, 9325599666
E-mail : purusahu_ngp@yahoo.co.in

**JAWAHARLAL NEHRU ALUMINIUM RESEARCH DEVELOPMENT
AND DESIGN CENTRE: NAGPUR**

SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS
ATTACHED TO BALANCE SHEET AS ON **31ST MARCH, 2019**

PART A: SIGNIFICANT ACCOUNTING POLICIES

1. *The Centre is following Mercantile System of Accounting*
2. Depreciation is provided on assets put to use, on Straight Line Method as per the rates specified under the Companies Act, 1956.
3. Fixed Assets are stated at cost of acquisition, inclusive of freight, Octroi, Duties and taxes and incidental expenses related to the acquisition.

PART B: NOTES ON ACCOUNTS

1. The Centre being established as an R & D Centre is not self-sufficient. The expenditure over and above the income generated is bridged by the Revenue Grant provided by the Government of India. The depreciation on assets put into use is not reimbursed in the Revenue Grant.
2. The excess of expenditure over income amounting to Rs. 6,26.89,829/- has been carried over as Excess of Expenditure over Income in the Balance Sheet.
3. Since this is a trust with registration under section 12(A)(a) of IT Act-1961, Income tax is not payable.
4. Previous year figures have been regrouped wherever necessary
5. Capital expenses incurred for the various specific projects are directly debited to project expenses and they are not capitalized, since the life of such types of assets are only few years. During the financial year a sum of Rs.117.56/- Lakhs incurred for purchase of assets for various project are debited to Income & Expenditure account.
6. Salary & Projects grants are released by Ministry of Mines, Govt of India on half yearly or annual basis normally. Thus the Centre utilizes the available funds /Grants (which is received for specific purposes) on temporary basis to meet the various committed expenditure which are recouped later on receipt of the allocated budget.
7. Interest from AMDF is yet to be released by the Ministry of Mines. Accordingly, a provision has been made for 2017-18 and 2018-19 (40.70 + 45) = Rs. 85.70 Lakhs as receivable from the Ministry.

For **P S SAHU & CO**
Chartered Accountants

For **Jawaharlal Nehru Aluminium Research Development
& Design Centre, Nagpur**

(P.S. SAHU)
Partner
Member No.129802
F.R.No.129249W

(A.G. Mukim)
Chairman

(ANUPAM AGNIHOTRI)
Director

(**R. SRINIVASAN**)
Secretary cum Sr. Admin Officer

<p style="text-align: center;">THE BOMBAY PUBLIC TRUST ACT-1950 SCHEDULE IX (VIDE RULE {17(1)}) INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31.03.2019 [2018-19]</p>						
<p>NAME OF THE PUBLIC TRUST: JAWAHARLAL NEHRU ALUMINIUM RESEARCH DEVELOPMENT & DESIGN CENTRE NAGPUR (Autonomous Body under Ministry of Mines , Govt of India)</p>						
EXPENDITURE	SCH	AMOUNT	AMOUNT	INCOME	SCH	AMOUNT
To Expenditure in respect of properties :-						
Rates, Taxes, Cesses		80,620		By Rent (Accrued) (realised)		-
Repairs and maintenance	F	13,207,307				-
Salaries	G	92,627,196		By Interest (Accrued)		-
Insurance		50,687		Interest on FDR		6,239,866
Depreciation		18,847,460		Interest Received on SB A/c		6,239,866
Other Expenses	H	11,478,967	136,292,237			
To Audit Fees / Expenses		40,664		On securities		-
To Printing & Stationery Expenses		556,894		On Loans		-
To Postage & courier charges		212,690		On Bank account		-
To Project expenses	I	39,439,763	40,503,786			
To Travelling Expenses		253,775		By Dividend		-
To Provision for Audit Fees & IT return fees	J	294,064	294,064	By Donations in cash or kind		-
To Miscellaneous Expenses		-				
To Depreciation		-		By Donation from Trustees	K	73,008,461
To Amount transferred to Reserve or specific funds.		-		By Grants		73,008,461
To Expenditure on object of the Trust :-				By Income from other sources		
a. Religious		-		Technical Testing Fee		10,428,700
b. Educational		-		Income from Research Projects	L	19,138,554
c. Medical Relief		-		Miscellaneous Receipts	M	4,137,779
d. Relief of poverty		-		Technical Seminars / Training		
e. Other Charitable objects		-		Program Receipts	N	1,446,898
e. Other Charitable objects		-		Prior Period Income Against Sundry Debtor		-
		-		By Amount Written off		-
		-		By Contribution For Visit		-
		-		Excess of expenditure over income carried over to B/S		35,151,931
To Surplus carried over to B/S.				TOTAL		62,689,829
TOTAL			177,090,087	TOTAL		177,090,087
<p>AS PER OUR REPORT OF EVEN DATE ATTACHED FOR P.S. SAHU & Co</p>						
<p>For Jawaharlal Nehru Aluminium Research Development & Design Centre.</p>						
		(A.G. MUKIM) CHAIRMAN			(ANUPAM AGNIHOTRI) DIRECTOR	(R SRINIVASAN) SECRETARY CUM SR ADMIN OFFICER
		C.A. PURSHOTTAM SAHU PROPRIETOR Member No.129802 FRN.129249				

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE -NAGPUR		
(F.Y.2018-2019)		SCHEDULE - F
PRE YEAR	REPAIRS AND MAINTENANCE	AMOUNT
19250	Township	16014
125715	Electrical Works	159665
81837	Office building /Technical complex	75218
95490	Rep & Maint Office Vehicles	107849
38715	Rep & Maint Guest house	25501
0	Rep & Maint Office Furniture	20987
341007	TOTAL	405034
5528098	Rep & Maint (Major Non Recurring civil work)	12802273
5869105	GRAND TOTAL REPAIR & MAINT	13207307
		SCHEDULE - G
PRE Year	PARTICULARS SALARY COMPONENT	AMOUNT
58904957	Salary and Allowances	57807655
899000	Children Education Allowance (CEA)	891000
4750000	Gratuity Contribution to LIC	6000000
120834	Staff Bonus	117436
1395374	Medical Reimbursement	1364837
6057158	Employer's Contribution to EPF	5759254
3903851	Leave Encashment	699350
347000	Administrative charges on EPF	251340
945	Administrative charges on EDU	0
38400	Employer's Contribution to EDLI	39750
38835	Group Insurance scheme (GIS)	171147
458268	LTC expenses	1289154
775698	TA expenses	2813583
2017571	Salary / wages paid to Electrical contract staff	2082579
1935301	Salary / wages paid to Gardening & General Maint contract staff	2029151
3932297	Salary / wages paid to Housekeeping contract staff	4032182
4864845	Salary / wages paid to Security Services contract staff	5817779
213000	Salary paid to Consultant (Admin / Stores)	305357
387840	Salary paid to Consultant (Technical)	871200
33879	Salary paid to Lab Asst. (Contractual)	253000
0	Salary Scientific Asstt (Contractual)	359282
0	Salary (Admin IT / Lib)	92400
91152649	Total Salary Exp.	92627196

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
F.Y : 2018-19		
		SCHEDULE-H
PREVIOUS YEAR	PARTICULARS	AMOUNT
	ESTABLISHMENT EXPENSES	
332591	Printing and Stationery ref sch-ix	0
76606	Postage & Courier ref sch-ix	0
108181	Telephone / Fax charges	86677
167278	Internet/ Broadband charges	163703
198795	Office Expenses	237905
192497	Travelling exp. (Fuel and oil vehicle) ref sch-ix	0
3450	Subscription to Periodicals	7195
80620	Rent, Rates and Taxes	0
17303	Entertainment	12564
945314	Legal Expenses	0
2167914	Seminars and Conferences	1528713
161135	Staff Canteen / welfare exp.	238613
30102	Advertisement	41589
241867	Meeting expenses	217726
58952	Computer Stationery/Consumable /Anti-Virus	21264
133763	Republic / Independence day / Foundation day	24247
52434	Audit Expenses ref sch-ix	0
36305	Hindi Programme exp	52658
48000	Patent filling exp	0
25515	Plantation Expenses	112305
308015	Library & Information Expenses	188370
30603.39	Bank Charges	30119.84
42259	Recruitment expenses	123159
42000	Honorarium	7000
9962	GST Payment	1910155
5511461	TOTAL (Establishment Exp)	5003963
4425749	UTILITY EXPENSES	6475004
9937210	GRAND TOTAL (Other Exp)	11478967

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
FY : 2018-2019		SCHUDULE - I
PRE YEAR	PROJECT EXPENSES(2018-2019)	AMOUNT
202941	S-17 Development of real time instrument / system (SSAG)	0
1151893	S-18 Development of Super thermal Al. alloy (STAL) (SSAG)	30477
268054	S-19 Development of refractory material from saprolite (SSAG)	189277
9225155	S-20 Development of process model etc using porthole dies (SSAG)	9474531
1806818	S-21 Synergistic Utilise of aluminium waste (SSAG)	1938889
301530	S-22 Devp Strip Casting (SSAG)	1060445.28
376891	S-23 Effect of Modified seed properties (SSAG)	1766478
2003707	S-24 Large scale Digital Database of bauxite(SSAG)	975455
33632	S-25 Fabrication of adv ceramic nanocoatings for automotive(SSAG)	386652
1000	S-26 Fabrication of Adv Ceramic nanocoatings -automotive appi (SSAG)	786322
0	S-27 Estimation of Morphodynamicity (SSAG)	1087849
6129	S-28 Status report on work carried out on Red mud Project (SSAG)	1514390
0	S-29 Al scrap recycling (SSAG)	404510
0	S-30 Fire Retardacny Nano (SSAG)	521634
77000	N 32 NALCO Hand Spectrometer analysis of impurity project	0
368070	N-38 NALCO Otimisation of Parameter	5000
856344	N-39 NALCO Strip Casting project	144000
2271568	N-40 NALCO Mechanical Activation of Bauxite	171542
1894707	N-41 NALCO Studies on trace impurities project	996612
1696853	N-42 NALCO Utilization of PLK project	630014
58181	N-43 NALCO Devp of Inline Automates anode	700944
20662	N-44 NALCO Devp of A Wi Fi enabled sensor	780332
7968	N 45 NALCO Devp of ceramic Proppant from PLK	814397
394428	Nalco Training Programme	269683
35000	P 48 VEDANTA / Sesa Sterlite Al Dross project	0
25000	P 49 VEDANTA / Sesa Sterlite SPL Project	4000
5000	P-52 L & T Characterization technological testing	0
5000	P-54 BALC Beneficiation of low grade bauxite	0
1747342	P-55 DST Utiliztion and Devp of process for recovery of rare earth	1879632
31720	P-56 Hi Tech Metal raipur. Characterisation studies of raw matis- dross	47552
0	P-57 Measurement of bath parameters for Hindalco Hirakund	989465
0	P-58 Vedanta Technological testing of Bauxite	205190
0	P-60 3N Pure alumina LED(DST)	15057
14970	BEE (EESL) Project	0
560673	MECL Nagpur Testing Project work	803285
1901169	DPR grant expenses	8272122
439292	In house R & D Work	25435
1678515.9	G S I Tesing work	748502.56
0	NABL Certification	1800089
27349203	TOTAL (Project Exp)	39439763
Miscellaneous Lab Operational Exp (2018-2019)		SCHEDULE - J
PRE YEAR	PARTICULARS	AMOUNT
8500	AMC Lab equipments & others	0
12081	Lab Operational & Consumables / Spares	51750
176775	AMC Computers	181000
0	Prier period Expenses	61314
197356	TOTAL (Miscellaneous Exp)	294064

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
F Y: 2018-2019		SCHEDULE - K
GOVERNMENT GRANTS		
PRE YEAR	PARTICULARS	AMOUNT
4070000	GOVT REVENUE GRANT FROM AMDF	4500000
57900000	GOVT SALARY GRANT	55473000
Ministry of Mines Govt. Grants for Science & Technology Projects		
524856	S-19 Devlopment of refractory material from saprolite (SSAG)	58317
4816800	S-20 Process Model of alloy porhole die (SSAG)	0
2100000	S-21 Synergistic use of waste for making geopolymers (SSAG)	0
450000	S-22 Devp. Strip cast aluminium alloys (SSAG)	0
0	S-23 Effect of Modified seed properties (SSAG)	1817100
0	S-24 Large scale Digital Database of bauxite(SSAG)	1297053
3134000	S-25 Nano Processing of industrial rejects (SSAG)	0
700000	S-26 Fabrication of adv ceramic nanocoatings for automotive(SSAG)	648000
700000	S-27 Estimation of Morphodynamicity project (SSAG)	800000
814000	S-28 Status report on work carried on Red mud Project (SSAG)	1684891
0	S-29 Techno Eco Survey of Al Scrap (SSAG)	2050000
0	S-30 fire retardancy Nano(SSAG)	699000
0	S-31 Bench scale study of Al ₂ O ₃ extraction from CFA (SSAG)	3820500
1000000	Govt Grant. IEC for Seminar - ICNFMM-2017	0
25125000	Govt grant for R & M Civil work / Lab upgradation	0
0	DST Govt Grant for TIFAC Bauxite Seminar	160600
101334656	TOTAL (Government Grant)	73008461

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
INCOME FROM RESEARCH PROJECT		
F.Y- 2018-2019		SCHEDULE - L
PRE YEAR	PARTICULARS	AMOUNT
2194560	N-38 Optimisation of Parameter project, NALCO	0
0	N-40 Mechanical Activatin of Bauxite, NALCO	2770560
0	N-41 Studies on trace Impuunties Project, NALCO	2250000
828480	N-43 Development of inline automated andoe project, NALCO	0
1184640	N-44 Development of a Wi Fi enabled sensor, NALCO	0
3842304	N-45 Development of Ceramic Propant PLK project, NALCO	0
240000	P-48 VEDANTA / Sesa Sterlite Al Dross project	0
325000	P-49 VEDANTA / Sesa Sterlite SPL Project	0
1187694	P-53 Synergistic use of waste for geopolymr (Swaraniata Holding)	0
0	P-54 Beneficiation of Low grate Bauxite Balco Project	0
1926000	P-55 DST Utiliztion and Devp of process for recovery of rare earth	1476000
400000	P-56 Characterization study Hi Tech metal Raipur	400000
0	P-57 Equip for online bath Hindalco	2000000
0	P-58 Vedanta Technoligical testing of Bauxtie	6600000
0	P-59 Extraction of ALF3 from low Grade Bauxite,(BAAS)	500000
0	P-60 DST on 3N pure Alumina LED	3141994
12128678	TOTAL (Income from Research Projects)	19138554

JAWAHARLAL NEHRU ALUMINUM RESEARCH DEVELOPMENT & DESIGN CENTRE :NAGPUR		
Miscellaneous Receipts 2018-2019		SCHEDULE-M
PRE YEAR	PARTICULARS	AMOUNT
99270	Misc Receipts	81435
46303	Licence fees and water charges	40438
287781	Guest house/ Qtr. rent / charges received	249558
157500	Tender Fees	137000
3090019	15 % common facility & HRA charges of NIMH	2396523
26000	Vendor registration fees	31000
135205	Sale of store materials/unservisable	0
11650	Application fees	13000
10006	Liquidated damages (LD)	228421
953709	Prior period income against written off of payble Amt EMI	764315
0	Prior period income not payable to debtor	196089
4817443	TOTAL (Miscellaneous Receipts)	4137779
Program Receipts : Technical Seminar/Training Program		
2018-2019		SCHEDULE - N
PRE YEAR	PARTICULARS	AMOUNT
770000	Training fees from Nalco	1323000
263559	Training fees Spectris etc	50000
1110359	Seminar on Downstream	0
34000	Seminar on WEM-2018	73898
2177918	Total (Program Receipts)	1446898