JNARDDC
Jawaharlal Nehru Aluminium Research Development and Design Centre
Autonomous Body
Ministry of Mines, Govt of India
Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur is centre of excellence set up in 1989 to create a research and development support system for the emerging aluminium industry in India by undertaking basic and applied research in the areas of bauxite, alumina and aluminium.

JNARDDC is an autonomous body of Ministry of Mines and 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.

JNARDDC is recognized as a scientific & industrial research organization by the Department of Scientific & Industrial Research, Ministry of Science & Technology, Government 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.

JNARDDC a joint venture is supported by the Ministry of Mines, Government of India and United Nations Development Programme (UNDP) has been fully functional since 1996. The serene setting of the campus coupled with a modern technical complex and state-of-the-art facilities provides an environment conducive for scientists to develop creative contributions to the technological growth of the Indian aluminium industry.

JNARDDC, with its limited and highly qualified manpower has developed speciality for providing high-grade technical support services to primary and secondary aluminium industries. The Centre has made key contribution in the areas of beneficiation, technological evaluation of bauxites, reduction of energy consumption & environmental pollution (by effective utilisation of aluminium industry residue materials such as red mud, dross, scrap etc.) aluminium process modelling and alloy development and indigenisation. 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.
An IIT-Kanpur alumnus, Dr Anupam Agnihotri has a Doctor of Philosophy Degree in Materials and Metallurgical Engineering from VNIT, Nagpur. Under UNDP, he has served as a visiting faculty to the University of Quebec in Canada as well as the Hungarian Research Institute. Dr Agnihotri is deeply involved in research activities on aluminum technology related to energy audit, environmental monitoring, modernization programs, low cost material alternatives etc. Presently, he is an integral member of several national-level projects such as the development of a Super Thermal Aluminium Conductor, Perform Achieve & Trade (PAT) studies and is also associated with DRDO’s ambitious project on indigenization of aluminium alloys.

EMPLOYEES
Journey of JNARDDC

1970s
- Discovery of East Coast Bauxite by GSI

1970s
- JNARDDC Established by MoM & UNDP

1996s
- JNARDDC Made Fully Functional

2014
- Silver Jubilee Year

2018
- 29 Years of Commendable Service
Vision

Develop indigenous technologies and provide value addition services to both primary and secondary aluminium industries with a special emphasis on energy reduction and environmental sustenance through scientific research and development for industrial growth and socio-economic development.

Mission

Provide modern technological inputs to aluminium industries and other sectors for value addition, reduction in energy / material consumption and environmental pollution based on optimum utilisation of existing facilities and further development of technical capabilities.
BAUXITE

• Principal ore of aluminium
• 5 to 7 kgs required to produce 1 kg of aluminium
• India has 5th largest deposits (3.8 billion tons) in the World
RESEARCH AREAS

• Databank development
• Characterization
• Beneficiation
• Analytical techniques

• Process & Product development
• Value addition of mine waste
• Geo-polymer development
• Rare earths extraction
• Nanotechnology
DOMAIN OF EXPERTISE

- Ore characterization and beneficiation
  - Chemical, mineralogy/phase analysis, morphology
  - Liberation studies (SEM-EDS & petrography)
  - Trihydrate alumina, monohydrate alumina, reactive silica, minor & trace elements

- Bond work index, Bulk density, Angle of repose

- Upgradation of low grade bauxite

- Utilization of laterite, PLK and Saprolite into products

- Rapid analysis of ore

- Training on Bauxite characterization and beneficiation
ADDITIONAL FACILITIES

Laboratory Ferrous Wheel Separator  |  Wet High Intensity Magnetic Separator  |  Lab Flotation Machine  |  Rotary Furnace
Rotap Sieve Shaker  |  Universal Impact Mill  |  Jaw & Roll Crusher
Alumina (Al₂O₃) is extracted from bauxite using the Bayer’s process.

- 2 kgs of alumina is required to produce 1 kg of aluminium.
- Melting point is 2072°C.
- India is 4th largest alumina producer in the World.
RESEARCH AREAS

• Technological studies
• Bayers' process unit operations
• Process audit

• Special alumina
• Red mud utilization
• Non-metallurgical applications
• Product and process development
DOMAIN OF EXPERTISE

• Pre-Desilication kinetics
• Desilication, digestion, precipitation & settling studies
• Mass and heat balance
• Energy audit of alumina refinery
• Optimization of process parameters
• Low soda hydrate & monohydrate production
• Optimization of liquor productivity
• Optimization of flocculent and crystal growth modifier
• Training on Alumina Technology
ADDITIONAL FACILITIES

- Low Temperature Bath Equipment
- Equipment for Precipitation Tests
- Mathematical Modelling
- Brick Making Unit
- Angle of Repose Apparatus
- Potentiometric Titrator

Precipitator
TOC
Autotitrator
Impact Mill
Bomb Digester
Large Scale Alumina Lab
Autoclave
ELECTROLYSIS

• Aluminium is extracted from alumina using the Hall-Heroult Process
• Requires 13-15 kWh to produce 1 kg aluminium
• India is 3rd largest primary metal producer in the World
• The energy consumption of the Hall-Heroult process costs for 80% of the total of the primary energy demand in aluminium production
RESEARCH AREAS

- Optimisation of operating parameters
- Process modeling & simulation
- Voltage & Energy balance
- Energy audit

- Carbon
- Physical characterisation
- Sensors & instruments for process parameters
- Potline emissions
• Electrical, thermal and magnetic measurements of pots
• Electrolysis process modeling and simulation
• Probe for instant bath parameter analysis
• Alternative raw materials for aluminium electrolysis
• Training on aluminium smelter technology
• Energy reduction
• Measurement of PFC emissions
ADDITIONAL FACILITIES

Data Acquisition and Processing System | Liquidus Temperature Measuring Instrument | Mercury Intrusion Porosimeter | Helium Pycnometer
ALUMINIUM
DOWNSTREAM

- Most abundant metal in the earth’s crust (8%)
- 2nd most used metal in the World
- Indian per capita consumption is 2.5 kg only
• Development and Indigenization of aluminium alloys
• Melt treatment and grain refinement
• Casting, forming, and joining of aluminium alloys
• Heat treatment of aluminium alloys

• Extrusion simulation & die design
• Failure analysis
• Recycling of aluminium
• Anodisation
DOMAIN OF EXPERTISE

• Characterization of aluminium alloys
• Melt loss reduction in cast house/foundaries
• Quality improvements in DC cast and formed products
• Simulation and Modelling techniques for complex die profile
• Energy audit of cast house
• Optimization of heat treatment cycles
• Process for joining Al to Al, Cu & steel using Friction Stir Welding technique
• Improvements in yield and quality in aluminium recycling
ADDITIONAL FACILITIES

- Extrusion Modelling and Simulation
- Electro Polishing Machine
- Ultrasonic Flaw Detector
- Brinell Hardness Tester
- Conductivity Meter
- Roughness Meter
- Heat Treatment Furnaces
- Anodisation
- FSW setup
- Extrusion Press
- Metallurgical Microscope
- DEFORM Software
- Micro Hardness Tester
- Induction Melting Furnace
- UTM With Environment Chamber
- Rockwell Hardness Tester
- Cupping Test
- Resistivity Meter
ENERGY

• Smelters are energy guzzlers
• World’s aluminium smelters consume ~ 3.5% of total global electric power
• Aluminium smelting is only 40-50% energy efficient
DOMAIN OF EXPERTISE

- Energy audit program for aluminium industry
- Energy reduction programs for aluminium Industry
- Preventive maintenance for aluminium industry, power plants, railways and ports
- Aluminium sector expert under “National Mission for Enhanced Energy Efficiency” by BEE, Ministry of Power
ENVIRONMENT

• Globally, aluminium industry emits around 450 MT of CO$_2$ eq annually (around 1% of World’s total emission)
• 2.5 to 3 tons of red mud is generated per ton of aluminium
• PFC has global warming potential of 5000-10000 CO$_2$ eq
• Spent pot linings contain leachable cyanide
• Aluminium industry is going to be carbon neutral by 2030
DOMAIN OF EXPERTISE

- Measurement of PFC emissions
- Detoxification of Spent Pot Lining (SPL)
- Utilization of Red mud, SPL, Dross, Fly ash
- Geopolymer products from industrial rejects
- Recovery of valuables from industrial rejects
- Environmental laboratory for aluminium industry
RESOURCE EFFICIENCY

• Aluminium helps protect the climate
• Aluminium is the best example of circular economy
• About 75% of all aluminium ever made is still circulating and is in use
• LCA of aluminium works on cradle to cradle basis
• Normally one kilogram of aluminum used in substitution of mild and high-strength steel in passenger cars and light trucks helps save more than 7.5 liters of fuel and reduces GHG emissions by 22 kilograms of CO₂eq in lifetime of the vehicle.
DOMAIN OF EXPERTISE

- Circular economy
- Aluminium recycling
- Zero waste concept
- Value addition of industrial rejects
ADVANCED RESEARCH FACILITIES

- CNC Wire Cut EDM
- SEM with EDS & EBSD
- Particle Size Analyser
- Thermal Camera
- Wet Chemical Lab
- DSC
- ICP
- TLC
- Surface Area Analyser
- XRD
- Glow Discharge Spectrometer
- XRF

- Ion Analyser
- Optical Scanning Densitometer
- Thermal Analysis System
- Geo-Polymer Brick Plant
- Microwave Digestion System
- Furnace
PRODUCTS & PROCESSES DEVELOPED

- Colourimetric determination of calcium in alumina hydrate, calcined alumina & process liquor.
- Rapid analysis of reactive silica in bauxite & laterite.
- Selective reduction of Al2O3, SiO2, Na2O and CaO in red mud for enrichment of Fe2O3.
- In-situ dissolution of alumina and silica in bauxite for geo-analytical applications.
- Bauxite Databanks.
- FSW Process.
- Low Soda Hydrate.
- Die Design & Extrusion Simulation.
OUR ASSOCIATES

nalco
NALCO

IBASS

IBASS

IIM

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MRSA

MRSA

Dr. C. V. Raman University

Dr. C. V. Raman University

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RAJ Chemicals Pvt. Ltd.

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MECL

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DRDO

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Bry-Air

Bry-Air

calderys

Calderys

CHRIST

CHRIST

bhpBilliton

bhpBilliton

ZIM

ZIM

TAL

TAL

Hindalco

Hindalco

Associated Aluminium Industries Pvt. Ltd.

Associated Aluminium Industries Pvt. Ltd.

Swarnlata Holdings Pvt. Ltd.

Swarnlata Holdings Pvt. Ltd.