

## **RESEARCH & DEVELOPMENT**

### **EMPOWERED COMMITTEE ON RESEARCH & DEVELOPMENT**

Research & Development in the iron and steel sector is normally being carried out by the steel plants, academic institutions and national research laboratories. However, to supplement and encourage research activities in the iron and steel sector, Govt. of India is providing financial assistance from the Steel Development Fund (SDF) for some of the R&D projects received from the public and private sector steel plants, national laboratories, academic institutions etc. Thrust areas of the R&D projects, so assisted, are given below: -

- Design & development of new technologies & production processes.
- Reduction in raw material and energy consumption.
- Development of Human Resources.
- Utilisation of waste materials.
- Environment management and pollution control.
- Development of new value added products.

An Empowered Committee under the Chairmanship of Secretary to the Government of India, Ministry of Steel with members from Department of Science & Technology, Department of Scientific & Industrial Research, Steel producers in both private and public sectors, Indian Institute of Technology (IIT), Kharagpur, National Metallurgical Laboratory (NML), Jamshedpur, MECON Ltd, and others was set up on 24.2.1998 with a view to providing overall direction to the total research effort on iron and steel in the country and approve specific research projects placed before it for funding fully or partially, from the SDF.

Since it was set up, the Empowered Committee (EC) has met 9 times and approved 31 R&D projects. The total cost of these 31 projects is Rs.212.73 crore. Out of this, Rs. 99.573 crore is to be met from the SDF of which so far Rs. 72.487 crores has been released.

### **Achievements/ Benefits from the completed R&D projects.**

Out of the 31 R&D projects, 16 projects have been completed yielding benefits in areas of Iron & Steel making processes, up-gradation of Raw material, product development, increase in productivity, reduction in refractory consumption during steel making, reduction in energy consumption in Electric Arc Furnace/Induction Furnace sectors etc. 3 projects have been stopped after mid course review and the remaining 12 are in progress.

### **Research & Development by individual iron & steel plants:**

Iron and steel producers, both in the public and private sector, continue to pursue their research and development activities to deal with their plant specific problems, assimilate and innovate newer technologies, utilize Indian minerals and raw materials in larger proportion, reduce pollution, conserve energy and reduce cost of production.

Total amount of money spent in Research and Development by Iron & Steel Plants and other related industries during the last three years were as follows:-

(Rs. in Crore)

	2001-02	2002-03	2003-04
<b>(a)Public Sector</b>			
Steel Authority of India Limited	49.85	54.82	70.0(P)
Rashtriya Ispat Nigam Ltd.	2.50	2.50	2.50
National Mineral Dev.Corp.	5.64	6.39	4.06(P)
Kudremukh Iron Ore Co. Ltd.	6.5	14.5	1.60
Manganese Ore India Ltd.	0.90	0.97	0.90(P)
Sponge Iron India Ltd.	0.04	0.06	0.06
Bharat Refractories Ltd.	0.33	0.15	0.30
MECON Ltd	0.39	0.41	0.27
<b>Sub Total (a)</b>	<b>66.15</b>	<b>79.80</b>	<b>79.69</b>
<b>(b) Private Sector</b>			
Tata Iron & Steel Co. Ltd.	7.52	16.33	24.25 (P)
Mukand Ltd.	0.25	0.21	0.22
Jindal Vijayanagar Steel Ltd.	0.39	1.35	2.40 (E)

Jindal Steel & Power Ltd.	0.82	1.27	0.02 (E)
Mahindra Ugine Ltd.	0.99	0.50	0.40
<b>Sub Total (b)</b>	9.97	19.66	29.29
<b>Grand Total (a+b)</b>	76.12	99.46	108.98

### **STEEL AUTHORITY OF INDIA LIMITED (SAIL)**

Research & Development Centre of the company has undertaken 94 R&D projects during the year 2003-2004. Out of these, 12 projects have been completed during the period April to September, 2003.

#### **Areas covered in R&D activities are:**

- Quality Improvement
- Cost reduction
- Yield/ Productivity Improvement
- Energy Conservation
- New Technology/ Product Development
- Waste Management/ Pollution Control

In addition, RDCIS undertook contract research work and provided significant consultancy services and know-how to organisations outside SAIL yielding external earning of Rs 41.42 lakhs up to September'2003.

### **RASHTRIYA ISPAT NIGAM LIMITED (RINL)**

At RINL, Research and Development (R&D) efforts are directed towards the following.

- **Troubleshooting** to come up with technological solutions to the problems faced in the routine operational activities through investigative study, failure analysis and critical examination of the process parameters.
- **In-depth study and analysis on subjects of major technological importance** to evolve strategic options for future course of action.
- **Establishing a “market - production - technology” linkage** in order to develop new and value added products catering to market demands and customers' requirements.

Based on the marketing information/survey, 17 new products have been developed to cater to the customers' requirements.

#### **Research activities undertaken**

1. Oxygen enrichment at blast furnace
2. Study of requirements of effective slag splashing at converter
3. Quantitative determination of proeutectoid phases in high carbon wire rods
4. Study of scale formation and descaling behaviour of the steel manufactured at VSP

#### **NATIONAL MINERAL DEVELOPMENT CORPORATION (NMDC)**

Some of the major assignments taken up/in progress/completed during the year 2003-2004 (Apr.-Sept.03) are as under:-

- Technology Development Projects
  - a) Production of Carbon Free sponge iron powder and value added products thereof.
  - b) Production of Power Ferrite Powder from Blue Dust concentrate.
  - c) Nano-Crystalline iron powders.
  - d) Joint Research Project between NMDC and MISA is investigating the properties of Nano-crystalline iron powders from Blue Dust.

#### **KUDREMU KH IRON ORE CO. LTD. (KIOCL)**

The R & D activities at KIOCL are directed towards quality improvement through process development/modifications to suit multi product needs and to modify Process Flow Chart to cater to the present run of mine ore characteristics. Specific areas are :-

- Upgrading of magnetic concentrate for meeting customers' requirement.
- Use of alternative raw material for continued operation of the Pellet Plant at Mangalore.

- Preliminary test for exploring the amenability towards pelletisation using alternative raw material viz. Hematite iron ore as feed to the Pellet Plant has been conducted. Test has shown encouraging results.

### **MANGANESE ORE (INDIA) LIMITED (MOIL)**

The thrust of the company's R & D efforts is directed towards meeting the challenges of safe and cost effective mining of manganese ore at increasing depth. The main areas where the R & D efforts of the company have been directed in the recent past and will continue to be directed are as follows:-

- Development of better and improved mining methods.
- Development of new support systems in the underground workings, and improvement in the existing support methods and practices.
- Development of benefaction methods and cost effective technologies for the upgradation of ores.
- Development of manganese based chemicals.
- Exploration of new deposits, feasibility studies for enhancement/upgradation of ore reserves.
- Technology upgradation in specific operations for enhancement of productivity, improvement in safety, reduction in costs, and optimisation of manpower used.

#### **On-going R&D for continuous improvement in existing practices:**

- Rock Mechanics instrumentation, and application of the recent advances in rock mechanics for monitoring the ground behaviour in the underground mines.
- Pit slope stability studies in the open cast mines, and optimisation of slope angles to reduce the development costs.
- Blasting studies in the underground as well as open cast mines, for optimisation of blasting parameters, reduction in explosive consumption and blasting costs, and improvement in the fragmentation of the blasted material.

## **MECON LIMITED**

### **Projects Completed :**

- “Confocal Microscope for Biological Applications” – A DST sponsored project successfully completed in June 2003 as per schedule.

### **Ongoing Projects :**

- MECON has developed a new process technology to use chromite overburden for producing nickel-chromium bearing alloyed pig iron first time in the country under the R&D project entitled “Studies on production of alloyed pig iron and low alloy steel using chromite overburden” jointly funded by Ministry of Mines, Ministry of Science and Technology and MECON. Recently industrial trials were carried out successfully in Blast Furnace No.2 of IKIWL, Barbil and about 260 tonnes of alloyed pig iron was produced.
- “Miniaturization of Thermoelectric Cooling Unit for Tank Crew”. This is an ongoing sponsored project fully funded by DIPAS, DRDO, Delhi.
- “Heating gloves and socks at an ambient temperature of (-15)°C for defence personnel”. This is an ongoing sponsored project fully funded by DIPAS, DRDO, Delhi.
- “Solid State Cooling/Heating of ‘IR’ Optics for ‘NAG’ Missile”. This is an invited proposal submitted to DRDL, Hyderabad for evaluation and financial sanction.
- “Laser Line Marking System for Plate Mill”. The proposal has been submitted to Bhilai Steel Plant for evaluation and funding.
- “Development of LED Opacity Monitor for on-line Measurement of Particulate Emissions”. This is an ongoing sponsored project fully funded by MOEF, Govt. of India.

## **BHARAT REFRACTORIES LIMITED (BRL)**

The specific areas in which R&D was carried out by the company were:

1. Mag A1 Spinel Bonded Castables
2. Mag A1 Gel Bonded Castables
3. Development of Acid Proof Bricks & Mortar

4. Ladle Well Mix
5. Air Setting Cement
6. Inflow Mass for Slide Gate Valve System
7. Substituting Sea Water Magnesite with low cost DBM (98% Magnesite) in manufacture of MCB
8. Use of low Viscosity Novotac type resin suitable for normal counter current mixer
9. Substituting non-corrosive chemicals in place of corrosive chromic acid in masses.
10. Development of insert in Slide Gate plates for further cost reduction.

The above R&D work has helped in reducing cost of manufacture as well as development of new products.

#### **TATA IRON AND STEEL COMPANY LTD. (TISCO)**

Specific areas in which R & D was carried out by the company:

- Improvement in the coarse & fine clean coal yield.
- Studies on coke microstructure.
- Dry beneficiation of Khondbond iron ore fines.
- Analysis of Chemical grade iron ore concentrates.
- Characterization of beach sands from Tamil Nadu.
- Evaluation of Sintering characteristics of captive iron ores.
- Study on properties and the shelf life of BH grade CRCA
- Trials with HR IF strip with an objective to replace FM tubes by ERW tubes for plumbing applications.
- Development of a high chromated coating for fuel tank applications.
- Development of a thin organic coating (TOC) developed for enhancing corrosion resistance of coated products.

#### **JINDAL VIJAYANAGAR STEEL LIMITED (JVSL)**

##### **Objective**

Achievements and improvements in development of new processes, products, cost reduction, quality, energy conservation, waste management etc.

## **Specific achievements**

- **Indigenous non-coking coal for COREX**

Plant scale trials have been successfully carried out using indigenous Singareni unwashed grade 'B' coal to replace imported coal to the tune of 10 %. This project is partly funded by Ministry of Steel and Department of Science and Technology and has been carried out in collaboration with Society for Innovation and Development, Indian Institute of Science, Bangalore and Central Fuel Research Institute, Dhanbad.

- **Commissioning of Commercial Scale Iron Ore Beneficiation Plant Based on In-house developed Technology**

Based on the laboratory scale and pilot plant scale (2 tonnes/hr and 10 tonnes/hr) an iron ore beneficiation process was developed which has been successfully commercialised and 1.5 mpta plant is in operation

- **Use of Organic Binder in Pelletisation Process**

Use of organic binder in pelletisation process has been tried successfully in Pellet Plant. Further, high bed height operation has been introduced which has enhanced Pellet Plant productivity and the plant is now operating at rated capacity.

## **JINDAL STEEL & POWER LIMITED (JSPL)**

Specific areas in which R & D are carried out by the company

- Standardisation of process for Blast Furnace
- Standardisation of process for Coal Washery & Mines
- Measurement of gases in steel and its control
- Standardisation of rolling parameters of parallel flange , beams and columns.
- Development of Forging quality Steels micro alloyed steels for high tensile strength and weldability applications
- Up gradation of testing facilities (XRF for Blast Furnace metal, slag and ferroalloys analysis).



### **Benefits derived**

- Production of basic grade of hot metal , which has been used in steel melting shop has led to increase in productivity by 100% and reduction in specific energy consumption by 40%.
- Blast furnace achieved productivity of more than 2 by standardisation of operating parameters.
- By adoption of more efficient methods of coal beneficiation through heavy media cyclone separation, higher yield of clean coal of lower ash content has been achieved. This has helped rotary kilns to increase the productivity of sponge iron.

### **ISPAT INDUSTRIES LIMITED (IIL)**

At IIL, R&D initiatives are directed towards product development & Process development.

- Development of steel for cold rolling, galvanising, cold forming for various applications.
- Development of zero Spangle Galvanized steel
- Development of EDD steel for critical/external Automobile application.

### **New Processes developed:**

- Development of dummy bar for all widths in CSP Caster.
- Use of HSS rolls in the finishing stand for quality improvement and reduction of grinding cycle.
- Propane injection at DRI plant of Midrex for productivity increase.
- Oxygen injection through bustle pipe in DR plant to increase the productivity and metallization
- Coating of tundish with lime to absorb Alumina in the tundish to avoid clogging.

## **MAHINDRA UGINE STEEL CO. LTD.**

The following specific R&D work had been undertaken :-

- i) New Spheroidising cycle for SAE 52100/100Cr6 bearing steel has been designed to reduce the total cycle time from 68 Hrs to 34 Hrs.
- ii) Decarburisation of Spheroidised SAE 52100 steel has been eliminated by improved process design.
- iii) Improvement of quality of steel (cleanliness) by designing the deoxidation practice.
- iv) Reduction in the use of costly ferroalloys by modifying steel making practice for different grades of steel.
- v)** Reduction in cycle time of EAF/LF/VD.

## **MUKAND LTD.**

### **Achievements of R & D**

- Precipitation Hardening (PH) grade stainless steels have now been developed to cater to the domestic and export market.
- Quality of Cold Heading Quality (CHQ) steel grade wire rods has been improved by minimizing the decarburization levels.