

XI International Seminar on
Mineral Processing Technology



15–17 December, 2010

Volume-I

EDITORS

R. Singh

A. Das

P.K. Banerjee

K.K. Bhattachryya

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JOINTLY ORGANISED BY :



National Metallurgical Laboratory (CSIR)



Tata Steel Limited



Indian Institute of Mineral Engineers

Jamshedpur, India



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FOREWORD

There are growing concerns about the depletion of good grade ores and coals at a fast rate, and more so with the rapid industrial growth in the country. This coupled with the increased energy demand and more stringent environmental regulations have put a challenging task ahead of India to sustain its impressive growth rate and its aspirations towards a developed economy. Growth in the mining and mineral processing sector will be dictated by land, water, energy and environment. Research and development activities should focus on the utilization of low-grade and dumped ores and development of energy efficient and environmentally friendly processes. The coals used both for metallurgical industries and thermal power generation should be beneficiated for enhanced energy efficiency and minimization of waste. Technology has to be evolved for the processing of fine particles and development of zero-discharge processes. Besides, instrumentation and process control in the plants must be incorporated to ensure efficient operation as regards quality and productivity of mineral concentrates. This certainly requires a more innovative thinking and a strong sense of social responsibility. A concentrated and coordinated effort by the planners, plant personnel, engineers and researchers is required.

The National Metallurgical Laboratory (NML), Jamshedpur in collaboration with Tata Steel under the aegis of the Indian Institute of Mineral Engineers is jointly organizing the XI International Seminar on Mineral Processing Technology (MPT-2010) during 15–17 December, 2010 and also bringing out a pre-print volume containing all the technical papers accepted for presentation and publication. This seminar is also part of the Diamond Jubilee Anniversary celebrations of NML this year.

I hope, this volume will be of immense interest and find use as a reference book among the academicians, researchers and the mineral processing practitioners in near future.



(S. Srikanth)

30th November, 2010
NML Jamshedpur

Chairman, Organising Committee, MPT-2010 &
Director, NML Jamshedpur

EDITORIAL

Minerals and mineral based products are an integral part of the economic and social fabric of modern society. Coal is equally essential in energy resources for the sustenance of life. Indian minerals industry has played an unassuming, yet indispensable role in facilitating the country's strong industrial growth. As a result, India is a leading global producer of a number of minerals and mineral based products. While India has performed fairly well in the field of mineral exploration and processing, it has ample scope in developing exploitation operations of its resources to optimal capacity.

Minerals are non-renewable resources, contributing significantly towards the expansion of the industries and economic growth of a nation. Depletion of high grade ores, generation of fines due to mechanized mining and enhanced environmental standards have posed serious challenges. The complexity of the problem is compounded by the fine nature of the assemblage of minerals. Additionally, today mineral industry is confronted with the challenge of increasing processing cost due to high costs of energy and manpower. Further, the global economic recession has adversely affected the mineral industry and the prices of mineral commodities. For the sustainable developments there is a need to address these challenges effectively. R&D efforts are being made worldwide towards developing innovative and eco-friendly technologies for the exploitation of mineral deposits with improved efficiency, lower energy investment and higher profitability.

Significant contributions in the field of technological development pertaining to mineral/coal processing have been made by NML, BARC, CIMFR, IBM in the past few decades. Organizations, like CMPDIL, IMMT Bhubaneswar, NEIST Jorhat and NIIST Thiruvananthapuram as well as R&D Divisions of corporate houses such as SAIL, TATA STEEL, NMDC, HZL, etc., also contributed immensely towards the technological development since they came into existence.

NML had developed several technologies to enrich the metallic values in minerals and ores through concentration. Dr. Shanti Swaroop Bhatnagar, in his address on inauguration of the Laboratory on 26th November, 1950 visualized that NML will come out with processes leading to the extraction of Fe, Ni, Cu, Zn, Sn, Co and Ti. True to his expectation research done in the field of iron and multi-metal sulphide ores beneficiation, nickel over burden, wolframite beneficiation, industrial minerals processing, coal preparation, etc., are noteworthy. The establishment and operation of bench scale and pilot plant scale beneficiation and agglomeration facilities in 1963, perhaps one of the oldest and largest in Asia, incidentally synchronizes with the establishment of public sector units in metals and mineral processing and coal washeries in India. NML Jamshedpur is celebrating its Diamond Jubilee this year. Jamshedpur is also known for its

first integrated steel plant established by Jamsetji Nusserwanji Tata more than 100 years ago.

In order to deliberate upon the above issues and keep abreast of the new developments, the XI International Seminar on Mineral Processing Technology (MPT-2010) is being organized at National Metallurgical Laboratory (NML), Jamshedpur, India during December 15–17, 2010. MPT-2010 is jointly organized at Jamshedpur by NML and Tata Steel as a part of the Diamond Jubilee Celebration of NML, under the aegis of Indian Institute of Mineral Engineers (IIME). Jamshedpur is located in the state of Jharkhand which is one of the richest states in mineral wealth in India and is considered to be the storehouse of mineral resources. MPT-2010 has provided a platform to mineral engineers, scientists, researchers, academicians and the plant operators for close interaction and exchange of ideas on different aspects of mineral processing and address the challenging problems faced by the mineral industry today. The present volume consists of papers under deliberation in MPT-2010 covering different aspects of mineral processing. The topics are grouped into fifteen sections namely: (1) Characterisation; (2) Comminution and Classification; (3) Gravity and Magnetic Separation; (4) Flotation, Flocculation and Surface Chemistry; (5) Modelling and Simulation; (6) Coal Processing; (7) Beneficiation of Iron Ores; (8) Processing of Strategic Minerals; (9) Processing of Industrial Minerals; (10) Agglomeration; (11) Hydro and Electro Processing; (12) Bio-processing; (13) Pyrometallurgical Processing; (14) Treatment of Waste and Environmental Issues; and (15) Allied Topics.

We are thankful to all the authors contributing papers towards the seminar. Thanks are due to all sponsors, exhibitors and advertisers for their support towards success of the seminar and publication of the volume. We are sure this volume will go a long way to serve the future researchers as a useful reference book.

14th December, 2010
Jamshedpur

R. Singh
A. Das
P.K. Banerjee
K.K. Bhattacharyya
N.G. Goswami
(Editors)

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