Preface

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The Conference on Advances in Process Metallurgy (APM-2019) was organized during July 4–5, 2019, at the Indian Institute of Science (IISc), Bangalore. The importance of process metallurgy for the growth of the mineral processing and iron and steel industries of the country cannot be overemphasized. The continuous depletion of the high-grade mineral deposits, scarcity of water resources in the vicinity of mining areas, stricter environmental regulations and increasing global competitiveness, have posed enormous technical and business challenges to produce marketable end products in a sustainable manner. The situation is further compounded by the shortage of skilled manpower, specialized in mineral engineering and process metallurgy. Needless to mention, the topic of the Conference is very germane to the present scenario confronting the mining and metallurgical industries, both within and outside the country.

The technical program schedule of APM-2019 comprised of 3 plenary talks, 14 keynote lectures, 11 invited talks and 22 oral presentations. A dedicated poster session

was also organized for young researchers and student participants, in which 13 posters were exhibited and presented. The international speakers were invited from Sweden, USA, Poland, Australia, Norway, South Korea, Nizwa, China, UK and Russia. The speakers from India represented academic institutions such as the Indian Institute of Technology (IIT), National Institute of Technology (NIT), Delhi Technological University (DTU), University of Baroda, Andhra University, apart from IISc, and research organizations such as National Metallurgical Laboratory (CSIR-NML), Institute of Minerals and Materials Technology (CSIR-IMMT), Bhabha Atomic Research Centre (BARC), Defence Metallurgical Research Laboratory (DMRL), Indian Bureau of Mines (IBM), Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC) and Tata Research Development and Design Centre (TRDDC). Participants from the industry included those from Rashtriya Ispat Nigam Limited (RINL), Hindalco, SLR Metaliks, MSPL Limited and Process Pumps (I) Pvt. Ltd. The technical talks were arranged in 2 parallel sessions. The topics deliberated at the Conference encompassed the following areas, namely, mineral beneficiation, bio-processing of minerals and materials, production processes related to ferrous and non-ferrous metallurgy (electro-, hydro- and pyro-metallurgy) and related unit operations, agglomeration, extraction processes related to strategic metals, theory and modeling in process metallurgy, environmental and energy-related issues.

Further, a separate session on mineral beneficiation was organized to commemorate the significant contributions made by Prof. S. Subramanian, Department of Materials Engineering, IISc, in the broad area of process metallurgy and in particular in the area of mineral beneficiation, to mark his retirement. A panel discussion was held at the

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concluding session which was addressed by Prof. S. Seetharaman, formerly KTH, Sweden, Prof. B. M. Moudgil, University of Florida, Gainesville, USA, Dr. Pradip, TRDDC, Pune, and Sri T. R. R. Rao, formerly Executive Director, KIOCL, apart from other delegates.

It emerged during the panel discussion that steel and cement continue to be foundational materials for the civilization and both these materials also happen to be the best examples to illustrate the success of engineering innovations leading to creation of value for the society. The challenge today is to re-engineer both these materials afresh, in this emerging era of fossil fuel free, renewable energy and environmentally conscious humanity, committed to reduce greenhouse gas emissions. It is in this context that we have to reinvent process metallurgy curriculum and prepare our next generation of engineers, so that they can lead the transformation of our industry. It is absolutely essential that in addition to regular structure, composition, property, performance paradigm, our engineers do possess the critical metallurgical process engineering skill sets. It is worth creating a new discipline, so that our engineers are familiar with the whole materials value chain—all the way from resources to final product, including recycling and life cycle analysis. In addition to the courses encompassing mineral processing and extractive metallurgy, these engineers should also be proficient in courses pertaining to engineering scale-up, transport phenomena, reaction engineering, surface and colloid chemistry, electrochemistry, modeling, simulation, instrumentation and control of unit operations, as well as in computer science (artificial intelligence and machine learning, integrated digital platforms, tools and technologies including robotics), so that they develop the necessary skill sets during their stay on campus. The future of process metallurgy is extremely bright

since the minerals, metals and materials value chain will have to be re-engineered to face the challenges ahead.

Out of the 38 full-length papers received, which are part of the proceedings volume brought out at the time of the conference, a few papers were selected subsequently for publication in this special issue. After due peer review, 16 papers have been recommended for publication in the special issue of Trans. IIM. These papers encompass a variety of topics in ferrous metallurgy, mineral processing, non-ferrous extraction, electrometallurgy, hydrometallurgy, modeling & simulation, resource recycling and environmental remediation. We are grateful to the authors for their contributions to this special issue. We thank them for their cooperation and help in meeting the deadlines. We express our sincere gratitude to all the reviewers for their precious time and their valuable inputs for improving the quality of papers being published in this special issue.

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Last, but not the least, we wish to express our sincere gratitude to Prof. B.S. Murty, Chief Editor, Dr. R. Sandhya and Dr. Arup Dasgupta, respectively, former and present, Managing Editor, Trans. IIM, and Ms. Harini Balasubramanian, Springer Nature Publications, for their timely help, valuable suggestions and encouragement to bring out this special issue of Trans. IIM, pertaining to the Conference on Advances in Process Metallurgy, 2019.

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