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SPECIAL ISSUE:

CHEMISTRY AND METALLURGY OF REFRACTORY AND REACTIVE METALS AND MATERIALS EXTRACTION AND PROCESSING. PART I

CONTENTS

EDITORIAL

The family of refractory and reactive metals has played a key role in the development of modern science and technology. In fact, the development of electronic, nuclear and space engineering owes a great deal to this group of metals. However, the technology involved in the production and processing of refractory and reactive metals is very complex and is totally different from those of the common metals. The reasons are too well known to need any elaboration here. In the past few decades, concerted efforts have been made towards the development of techniques and processes for the production, consolidation, purification and fabrication of these metals right from their ore bodies. As a result, altogether new techniques and processing concepts have emerged and the entire scenario of their process metallurgy today presents a different picture from what it was before.

The Special Issue entitled "Chemistry and Metallurgy of Refractory and Reactive Metals and Materials Extraction and Processing" of **High Temperature Materials and Processes** will appear in two parts and carries an assortment of authoritative contributions from experts and specialists, some of which will appear in this triple issue and others in a future issue. These contributions are essentially representative of the contemporary situation in this area and are intended to give readers an appraisal of some recent developments and a general appreciation of the special features of metallurgy and processing aspects of the refractory and reactive group of metals.

The two-part Special Issue contains over 25 contributed papers. Within the limited length of this editorial column, it is not possible to introduce all of them individually. I shall, therefore, try to outline a route along which I would like readers to move. Let us start off with a reference to the paper by Padmanabhan, Srinivas and Rao. This paper gives a broad picture of ore occurrences, and their nature and characteristics. It also gives an account of general mineral beneficiation processes and of recent developments and trends consistent with the progressively depleting nature of the ore bodies and with environmental pollution control. Molten salt electrolysis is one of established processes for the tonnage production of some of the refractory metals. The papers by Thonstad and by Sehra and Suri give an excellent coverage of this elegant metallurgical process, touching theoretical and practical aspects. Carbothermy is a very economic and facile route for the production of many metals including the refractory metals. Ono, in his paper, discusses the carbothermic reduction process for the production of niobium metal and its alloys and their purification and consolidation by electron beam melting. The physico-chemical aspects governing these processes are also treated lucidly.

Arc-plasma has recently emerged as a powerful technique in the implementation of the carbothermic process. A fine account of this technique as applied to vanadium and tantalum extraction can be found in the comprehensive presentation by Taniuchi. The paper entitled "Processing of Rare Metals" and written by Schreiber deals with industrial production and practice for a number of metals. This important paper incorporates many illustrations as well as a host of information from some renowned companies in Germany. Mukherjee and Gupta provide a lucid account of the chemical metallurgy of vanadium. One will find in their presentation many new approaches which may be worthwhile for the production of vanadium and its alloys. We have, perhaps, travelled too far too soon. If we travel back a little, we are introduced to an altogether new technique – electrooxidation. This technique holds considerable attractions as an environmentally acceptable and profitable avenue for processing some of the sulphidic sources of metals. The exhaustive review by Scheiner is replete with illustrations of this technique and its great utility in the treatment of molybdenite. An industrial slant is prevalent in the paper. If we now continue our journey, we cannot lose sight of two papers that deal with the purification aspects of refractory and reactive metals. This is a crucial step, particularly in the production scheme of the metals of our present concern. Carlson gives a masterly presentation of solid state purification processes. The electrotransport process perhaps takes the lead role particularly for preparing some metals like vanadium in their highest purity states. The paper by Singh provides an up-to-date review of the various purification processes.

Before coming to the end of our journey, we should take a look at the hard metal carbides which form the basic chips in the implements that are

commonly found in any fabrication shop. I am referring to the masterly presentations by Takatsu and Pierson which cover the entire gamut of cutting technology. In the same breath, let me also bring under reference the paper by Banerjee who very succinctly discusses the role of interstitial elements in rare and reactive metals and alloys. The properties of these metals are profoundly influenced by the presence of interstitial elements. A very little amount of them, either singly or in combination, renders these metals as brittle as pumice stone and makes them totally useless for any engineering application. The reader will be exposed to many additional aspects of this area while going through the paper.

Having reached thus far, let me have the privilege of leaving the rest of the papers of this two-part Special Issue to the readers. I shall deem my efforts amply rewarded if it draws a wide readership and serves the purpose of providing a panorama of the field to which it is devoted.

It is the authors who have played the central role in the making, shaping and developing of this Special Issue. I wish to express my very sincere appreciation and thanks to all of them for their efforts and whole-hearted co-operation.

Finally, I would like to take this opportunity to place on record my acknowledgements to H.E. Freund, the late S. Schomberg and B. Susswein, all of Freund Publishing House Ltd., for entrusting the responsibility of Guest Editorship to me and providing me with help in accomplishing this task. It has been a very rewarding experience to me at all stages of this project. On my side, I have had the unceasing assistance of N. Krishnamurthy and Poonam Khattar. My appreciation goes to them.

C.K. Gupta
Guest Editor