Russian Research on the Platinum Group Metals

The possibility—and indeed the need—for the creation of new alloys based on the platinum metals result from both technological developments in the using industries and scientific progress in the methods of physical metallurgy. An outline of the extent to which this field is being cultivated in the U.S.S.R., with some background information on the general approach to the problems involved, is given in a paper from two well-known Russian workers, Professor E. M. Savitskii, Head of the A. A. Baikov Metallurgical Institute in Moscow, and his colleague, Madame V. P. Polyakova. This is published in a special double number of *Journal of Less-Common Metals* (1975, **43**, 169–177) dedicated to Professor Ernst Raub on the occasion of his 70th birthday.

Professor Raub's very long career at the Forschungsinstitut für Edelmetalle in Schwäbisch Gmünd has, of course, been characterised by a great deal of research into the structure and the equilibrium diagrams of the platinum metals and their alloys, and his work is well appreciated in Russia, where physico-chemical research in this area was initiated under N. S. Kurnakov at the beginning of the present century and is continuing at the A. A. Baikov Metallurgical Institute of the Academy of Sciences.

Emphasising that the unique properties of the platinum metals make them available for wide technical applications in conditions where no other metallic or non-metallic materials can operate safely, Savitskii and Polyakova describe some of their work in their purification and in the production of single crystals for a closer study of their structure and properties. In the cases of rhodium and ruthenium, for example, they have shown that significant amounts of impurities, both metallic (Mg, Pb, Fe, Cu and Au) and non-metallic (Si, C, O, H and S) interact both with the basic metal and with themselves during melting, thereby of course influencing the mechanical properties and physical characteristics. By using arc and electron beam melting, and by zone refining in a high vacuum, purification of these metals has been achieved.

The fusible elements such as magnesium, aluminium, lead and silicon are well known to reduce significantly the life and operating temperature range of the platinum metals, these elements forming low melting point eutectics with the basis metal so that a thin layer is formed around the grain boundaries and failure can result.

A study of a polycrystalline sample of rhodium by scanning electron microscopy showed, for example, that glass-like oxide inclusions containing silicon and aluminium as well as other base metals could give rise to brittle fracture. This and other researches on the platinum metals have shown that the initial high purity of the basic metal is of primary importance.

Over the past twenty years or so a large proportion of the equilibrium diagrams of the platinum metals with other elements has been established. In the authors' laboratory recent work has been concerned with the interaction of palladium and ruthenium with tungsten, rhenium, vanadium, hafnium and the rare earth metals and this study is still continuing. In particular the work with the rare earth metals is helpful in assessing the desirability of their use for improving the structure and properties of the refractory platinum metals iridium, rhodium and ruthenium which Professor Savitskii and Dr Polyakova foresee as the main components of some new and effective metallic materials for use in modern technology. L. B. H.