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Technical Note

Structure of Some Iridium-Osmium Alloys

by H. C. Vacher, C. J. Bechtoldt, and E. Maxwell

IN the course of an investigation of the properties of metals at low temperature there was occasion to determine the constitution of four iridium-osmium alloys. There is very little information in the literature¹ on the constitution of synthetic Ir-Os alloys. Zvyagintzev^{2,3} has made a comprehensive study of different natural Ir-Os alloys and concludes that alloys containing more than 32 pct Os have the close-packed hexagonal structure of osmium, whereas those containing less than 32 pct Os have the face-centered cubic structure of iridium.

The alloys studied in this work were prepared by the American Platinum Works, Newark, N. J., and were received in the form of fragments approximately 1.5 mm average diameter. The fragments had been obtained by crushing ingots made by fusing charges of iridium and osmium under an arc and air cooling. The ingots were not given a homogenizing heat treatment. Sample fragments

Fig. 1—Microstructure of a 21 pct Ir-79 pct Os alloy. The iridium-rich phase is white. Etched electrolytically with 10 pct potassium cyanide solution. X100.

Table I. Results of X-Ray Diffraction and Microscopic Examinations

Alloy		Phases Present as Determined by		
		X-ray Diffraction		Microscope
Osmium, Wt Pct	Iridium, Wt Pct	Osmium Close-Packed Hexagonal Structure	Iridium Face-Centered Cubic Structure	
0	99.9	None	Present	1
23.6	76.4	None	Present	1
38.7	61.3	Present	Present	2
59.4	40.6	Present	Present	2
79.0	21.0	Present	Not detected	2
99.9	0	Present	None	1

Note: Chemical analyses of the iridium, osmium, and alloys were furnished by the American Platinum Works.

of the iridium and osmium used in making the alloys also were included.

Several fragments of each metal and alloy were examined microscopically and by X-ray diffraction. For the X-ray method the fragments were crushed further to pass a 270-mesh screen, then sealed in evacuated fused-silica tubes, heated to 1100°C for 18 hr, and allowed to cool in the furnace. Powder X-ray diffraction patterns were obtained from the annealed fragments by means of a Norelco camera

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having a diameter of 114 mm, and unfiltered cobalt radiation. For the microscopic examination several fragments in the as-received condition were mounted in Melmac, (American Cyanamid Co.) and ground using the conventional series of abrasive papers. The polishing was done with 0-2 diamond abrasive on a Microcloth (Buehler Ltd.) lap, wet with xylene. After polishing, the surface was etched electrolytically in a 10 pct solution of chromic acid or in a 10 pct solution of potassium cyanide. Both reagents attacked the osmium-rich constituent, whereas the iridium constituent was attacked slightly by the chromic acid reagent and not noticeably by the potassium cyanide reagent. The results of the X-ray diffraction and microscopic examinations are summarized in Table I. Fig. 1 shows the microstructure of a 21 pct Ir-79 pct Os alloy.

The results indicate an appreciable solid-solubility range of osmium in iridium as was reported by Zvyagintzev.³ The solid-solubility range of iridium in osmium is more restricted, apparently less than 21 pct Ir. This implies a large range of composition in which two phases can coexist that was not reported by Zvyagintzev.

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