Two of the contributions dealt with homogeneous catalysis by platinum metal compounds. P. R. Rony, of Monsanto, St Louis, gave a theoretical treatment of supported catalytic solutions, and showed that there should exist an optimum liquid loading for efficient catalysis. The system had been discovered independently by workers in both the Monsanto Company and the Johnson Matthey Research Laboratories (G. J. K. Acres, G. C. Bond, B. J. Cooper and J. A. Dawson, *J. Catalysis*, 1966, **6**, 139).

The various products obtained from the reaction of disubstituted acetylenes with palladous chloride were listed by P. M. Maitlis of McMaster University; in non-hydroxylic solvents, hexaphenyl-benzene is obtained almost quantitatively from diphenylacetylene. Dimethylacetylene in methylene chloride solution on the other hand reacts with palladium chloride to give only about 10 per cent of hexamethylbenzene, the remainder of the product being polymeric in nature.

G. C. B.

Iridium Coatings in Ion Engines

HIGH WORK FUNCTION AND THERMAL STABILITY

In their traditional miserly role, metals with a high work function are reluctant to part with electrons although when heated they accept them with great alacrity from materials of lower electron affinity. As an electron acceptor iridium is now being seriously considered as an improved ioniser material for use in caesium ion engines. This work is being carried out under the auspices of NASA by the Hughes Aircraft Company Research Laboratories, Malibu, California, and a recent report by R. R. Turk and W. E. McKee (1) describes some of the preliminary results obtained.

Thrust is obtained in these ion engines by the reaction of a stream of electrostatically accelerated caesium ions and an appreciable un-ionised flux rapidly destroys the accelerating electrodes. Although solid tungsten has been used as an ioniser it is easily flooded by the high flow rates of caesium now normally employed.

Porous tungsten with its high surface area is less liable to flooding but is unfortunately somewhat unstable and loses its permeability at the normal temperature of operation involved in these devices.

Attempts to produce complete ionisers of higher work function and improved thermal stability involved powder metallurgy studies on iridium and rhenium alloys. Porous compacts based on the 50 per cent iridium, 50 per cent tungsten composition had the hexagonal epsilon crystal structure and a high resistance to densification. Economic and practical considerations finally indicated that better results would be obtained by the application of thin layers of iridium and rhenium to porous tungsten substrates.

Iridium coatings were obtained by spraying dilute solutions of iridium trichloride on to heated tungsten compacts which were subsequently reduced in hydrogen. Half-micron coatings of iridium so obtained were stable for at least 200 hours in vacuum at 1500°C and work functions of 5.28 ± 0.03eV were measured on such deposits.

Electroplated rhenium surfaces were also effective. Although the work function of 5.20eV $\pm$ 0.03 determined for rhenium was comparable to that of iridium, it was found that rhenium, because of its high solubility in tungsten, provided a less stable coating than iridium.

Much further work will be required before the true effectiveness of these noble metal coatings can be properly assessed. It is interesting to speculate, however, upon the way in which osmium might behave under such conditions. The work function of osmium has been recently determined (2) as 5.93 ± 0.05eV a value higher than that of iridium and rhenium. Osmium also forms a carbonyl which might facilitate the deposition of uniform thin deposits on the tungsten substrate.

A. S. D.

References

1 R. R. Turk and W. E. McKee, "Alloy Ioniser Fabrication", NASA Contract No. NAS 3 – 6272, Hughes Aircraft Company, Malibu, California

2 P. Zalm and A. J. A. Van Stratum, *Philips Tech. Rev.*, 1966, **27**, (3/4) 69–75