properties. In particular the use of ZGS platinum and alloys has given improved service life, reduced metal inventories, and improved resistance to contamination, thus extending the applications for platinum in the glass industry. The continuing close relationship between suppliers and users will present further opportunities for progress to be made in glass production technology.

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A Study of Platinum Alloy Welds

THE EFFECT OF HYDROGEN CONCENTRATION

Considerable experience of the use of platinum alloys for glass-melting apparatus has now accumulated, and this shows that a key factor determining service life can be the integrity of the alloy in the proximity of welded joints. Brittle fracture of platinum alloys can result from contaminants entering the weld during fabrication or use, and a recently reported investigation by O. D. Smiyan, B. I. Shnaider, D. M. Pogrebiskii, L. A. Potapenko and E. I. Butkova of the E. O. Paton Welding Institute of the Ukraine SSR Academy of Sciences has considered the effect of welding technique on crack initiation and development (*Avt. Svarka*, 1986, **395**, (2), 10–12, 29).

The alloy used was platinum-20 rhodium-10 palladium-0.1 iridium-0.1 gold, in the form of a disc of 0.5 mm thick sheet which had been annealed for 30 minutes at 1000°C. Concentric welds were made by plasma micro-welding, either under an argon + hydrogen atmosphere or without a protective shielding, while the perimeter of the disc was held rigid. Microstructure, hardness and composition were examined and it was concluded that this alloy is highly resistant to crack formation during welding, that the use of the protective atmosphere does not affect the results, and that there is a relationship between welding sequence and the hydrogen distribution. Under unfavourable conditions the local hydrogen concentration can vary by more than 2:1, and may account for the reduced strength of some welded joints.

It is suggested that the formation of concentric welds, where the stresses are expected to increase as the diameter of the circular weld increases, is a convenient way of evaluating the weldability of a material.

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Solidification in Microgravity

Gravity induces significant disturbances in gaseous and liquid systems. These disturbances are manifested in the form of buoyancy, sedimentation, thermal convection and hydrostatic pressure. All these phenomena affect the solidification characteristics of liquid metals and alloys. By carrying out a solidification process in a microgravity environment, gravity-induced disturbances are virtually eliminated and the solid structures produced are unique in uniformity of composition and properties.

Undercooling experiments have been carried out on a number of refractory elements, including platinum, rhodium, iridium and ruthenium, in the free-fall microgravity ($10^{-6}g_0$; 1×10^{-5} Torr) environment of the drop-tube facility of the Marshall Space Flight Center by W. H. Hofmeister, H. B. Robinson and R. J. Bayuzick (*Appl. Phys. Lett.*, 1986, **49**, (20), 1342–1344).

Both platinum and rhodium achieved an expected cooling rate of between 17 and 20 per cent of their melting temperatures whereas iridium and ruthenium undercooled between 10 and 13 per cent. The latter effect was associated with heterogeneous nucleation caused by impurities. A high degree of undercooling on solidification is an important phenomenon in the production of amorphous, single crystal and metastable phase structures.

Clearly microgravity research is providing an understanding of material behaviour which will lead ultimately to new Earth- and Space-based products and processes. I.R.M.