very small grain size and a fine oxide particle size distribution, produced the longest creep life. At lower stresses creep failure was dependent upon the strength of the grain boundaries and upon microslip and diffusion. Under these conditions the rhodium alloys failed more quickly than ZGS 10 per cent rhodium-platinum, due to rapid diffusion of oxygen which caused internal oxidation and produced large oxide particles which acted as crack initiators. These oxides also prevented grain boundary sliding and microslip and recovery which would have prevented cavitation at the triple points. Failure occurred rapidly in alloys which contained elements that form volatile oxides, such as tungsten, carbon and sulphur, or which develop a non-protective oxide layer. These volatile oxides either promoted void formation or failed to prevent oxygen diffusing to existing voids at the grain boundaries. It is thought that the improvement in the creep life caused by the addition of indium may have increased the grain boundary cohesion.

Conclusions

This study has shown that it is now possible to manufacture many binary rhodium alloys, some of which have properties that may be useful commercially. For example, it is possible to make a rhodium alloy which will not colour glass, and which can be fabricated into products with an acceptable creep life. At high stress several of these rhodium alloys have a creep life superior to that of ZGS 10 per cent rhodium-platinum.

In addition, on certain rhodium alloys it is possible to produce a protective oxide layer which prevents the metal loss normally associated with the platinum group metals.

A similar account of work on ternary and other complex rhodium alloys will appear in a subsequent issue of this journal.

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Tribological Properties of Thin Platinum Coatings

It is known that the sliding wear behaviour of hard metals can be improved by coating one or both of the contacting surfaces with a thin layer of a soft metal, but this advantage can be lost by, for example, the formation of oxide or corrosion products. Therefore platinum with an annealed hardness of 48Hv and notable environmental stability would appear to be a suitable material for tribological applications, and the results of an investigation carried out at the National Institute for Materials Research, C.S.I.R., Pretoria, support this assumption ("The Use of Platinum in Thin Tribological Coatings", A. Wells and D. J. de Wet, *Wear*, 1988, **127**, (3), 269–281).

Their wear tests were carried out using a ball-on-flat rig; however the applied load was higher than that normally used for such tribological experiments. Alumina or steel spheres were used, the latter in both the uncoated condition and after sputter ion plating with platinum. The flat steel specimens were in the uncoated condition, or coated with platinum by sputtering, or by deposition from fused salt or aqueous electrolytes.

Both lubricated and dry surfaces were investigated in air at room temperature, and representative results are presented. Alumina sliders rapidly eroded thin platinum coatings, however on sliding steel surfaces the use of platinum reduced the coefficient of friction and the wear damage, and it is concluded that when the topography of the surface provides sinks for wear debris and reservoirs for lubricants, the use of thin platinum coatings on steel can provide excellent sliding properties.