

density range from 1 to 5 A/dm<sup>2</sup>. A similar critical effect of pH on electrolyte characteristics was found in tests of a commercial electrolyte of this type.

Finally, the authors also report preliminary results for an ammonia-free electrolyte based on ethylene diamine, the bath composition being 17.7 g/l palladium chloride, 5.9 g/l nickel chloride, and 80 g/l of the amine. In this case studies cover a wider pH range, a marked feature of the results being sharp peaks for both nickel and hydrogen contents at approximately the same pH value of about 5. Some results are also recorded for internal stress. The authors conclude that this type of solution has certain

advantages over the ammoniacal baths in terms of a stable pH value, absence of organic additives, and a milder chemical nature towards base metals and alloys such as copper and brass, against which must be set comparatively high values of compressive stress. This can, however, be minimised by selection of correct deposition parameters and/or by the use of stress reducers. It is to be hoped that further details concerning this type of solution, together with the results of studies, briefly mentioned, on the influence of various anions, such as chloride, sulphate, sulphamate and bromide, will be covered in a forthcoming publication which is in course of preparation.

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## Platinum in Aluminide Diffusion Coatings

The oxidation and hot corrosion resistance of high temperature nickel-base superalloy components can be improved by aluminide coating. Further improvements can be achieved by the use of platinum in these coatings (1), although the mechanisms by which platinum achieves this is still uncertain (2). Now a paper by W. T. Wu of the Institute of Metal Research, in the People's Republic of China and A. Rahmel and M. Schorr of the Dechema Institute, West Germany attempts to clarify the role of platinum in hot corrosion environments dominated by either acidic or basic oxide fluxing action (3).

Potentiostatic tests and free corrosion potential measurements were carried out with specimens immersed in melts of 90Na<sub>2</sub>SO<sub>4</sub> + 10K<sub>2</sub>SO<sub>4</sub> at 900°C in air. Under potentiostatic conditions reflecting acidic fluxing of protective oxide scales, it was observed that both coating systems and the uncoated alloy showed similar degrees of hot corrosion attack.

However, under conditions of severe basic fluxing of oxide scales, where high chromium and conventional aluminide coated alloys show extensive surface degradation, platinum aluminide coatings offer a distinctive performance advantage.

The free corrosion potentials of platinum aluminide coatings reached a steady state value of approximately  $E_{Ag} - 300mV$ , as measured over a period of 540 hours. In comparison, the simple aluminide coatings and the base alloy achieved a free corrosion potential approximately 200mV less noble than that of

any platinum aluminide system here evaluated.

Under acidic fluxing conditions degradation of the platinum aluminide coatings began by the formation of (Al,Cr)<sub>3</sub>S<sub>4</sub> sulphides adjacent to a platinum enriched alloy layer beneath an alumina protective scale.

Surface analysis of both coating types also revealed that the protective scales formed on platinum aluminides contained a high proportion of alumina. The presence of platinum in the outer scale also seemed to have a stabilising influence on alumina during acidic fluxing.

Similar effects of protective oxide modification and relative changes in coating element diffusion characteristics have also been observed at the Johnson Matthey Group Research Centre in nickel-base alloys containing platinum as an alloying element (4).

Clearly, the industrial need for new alloys and coating compositions with improved resistance to sulphur accelerated oxidation should spur further investigation into the mechanistic effects of platinum on oxide growth and stability. Wu and his two co-authors have provided some useful guidance in this direction.

I.R.M.

### References

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