

The platinum-modified aluminide coated blades are fit for re-use after 750 hours of engine operation and there is a high probability that they will be fit for re-use at full overhaul, that is after 1000 hours of engine operation.

Because of this substantial extension to the life of the blade, the Australian Defence Force had adopted the platinum-modified aluminide coating as the specified coating on first-stage blades in this engine.

References

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An Effective Oxygen Evolution Catalyst

In order to expedite the efficient photocleavage of water into hydrogen and oxygen using solar energy, catalysts must be efficient, stable, specific and fast-acting towards the reduction and oxidation of water. A great deal of progress has been made in the design of hydrogen evolution catalysts using for example colloidal dispersions of platinum, but the search for oxygen generation catalysts has been less successful and results reported on the activity of hydrated ruthenium dioxide ($\text{RuO}_2 \cdot x\text{H}_2\text{O}$) in this regard have been inconsistent and difficult to repeat. Now, however, workers at University College, Swansea have reported that pretreatment of hydrated ruthenium dioxide at 144°C for five hours gives an active, stable reproducible catalyst (A. Mills, C. Lawrence and R. Enos, *J. Chem. Soc., Chem. Commun.*, 1984, (21), 1436-1438). Yields of 97 to 98 per cent oxygen were obtained from the test reaction represented by the equation:

$$4\text{Ce}^{4+} + 2\text{H}_2\text{O} \xrightarrow{\text{RuO}_2 \cdot x\text{H}_2\text{O}} 4\text{Ce}^{3+} + 4\text{H}^+ + \text{O}_2$$

Conversion of the RuO_2 to gaseous RuO_4 can compete with the oxygen evolution reaction resulting in loss of ruthenium and low oxygen yields. In a series of experiments Mills found that the oxygen yield was inversely related to ruthenium loss as RuO_4 and depended on the temperature previously used for the heat-treatment of the $\text{RuO}_2 \cdot x\text{H}_2\text{O}$. From experiments in which samples of the catalyst were preheated at temperatures from 60 to 900°C it was clear

that optimum yields of oxygen were obtained with the samples heated at about 140°C (97 to 98 per cent yield). With higher treatment temperatures, the catalytic activity of the samples decreased, probably due to a lowering of the surface area, but no conversion to RuO_4 took place. Thermal gravimetric analysis of commercial samples of hydrated ruthenium dioxide indicated water contents of 19 to 24 per cent, but after treatment at 144°C for five hours, the water content was 7 to 10 per cent.

Mills concludes that the ability to catalyse the oxidation of water and the instability to anodic corrosion (that is conversion to RuO_4) are both related to the amount of water weakly bound to the powder, and both reactions possibly involve the same reaction sites. The tendency to loss of RuO_4 can be removed by the heat treatment. Much of the controversy surrounding the use of hydrated ruthenium dioxide as an oxygen catalyst may therefore be rationalised in terms of the degree of hydration, which may vary from one sample to another but heat treatment at about 140°C for five hours does give a stable, active and reproducible oxygen release catalyst.

These results represent an important step along the pathway towards viable catalyst systems for the water-splitting reaction, and should help to clarify the significance of earlier reports on the use of ruthenium dioxide for oxygen generation.

D.T.T.