PO3086

Oxidation behaviour of RuAl thin films: influence of diffusion barrier

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RuAl is a B2-structured intermetallic material with high melting point (2050ºC) which possesses outstanding thermodynamical stability in high-temperature aqueous environments. Moreover, RuAl presents good oxidation-resistance up to at least 1200ºCand strength at high temperatures. The good oxidation and corrosion resistance is due to the formation of a slow-growing protective Al_2O_3 layer, which has been found to be dense and compact. The protective Al_2O_3 layer scale possesses a thermal expansion coefficient (CTE) nearly equal to that of RuAl in a large temperature range, which makes this intermetallic favourable as protective coating material in applications that demand oxidation resistance (e.g. working layers for moulding dies). For that purpose, RuAl thin films were successfully synthesized using a PVD magnetron sputtering and deposited onto AISI 316L stainless steels. The present work targets on the study of the oxidation behaviour of nanocrystalline RuAl thin films. The presence at the grain borders of diffused Fe and Cr from the substrate in the RuAl films was observed in samples oxidised at 900°C for short periods (up to 1 hour). To avoid this effect, a diffusion barrier was deposited between the substrate and the RuAl film. The oxidation kinetics and oxide layer growth morphology was studied with and without diffusion barrier so as to determine how the Fe affects the intermetallic performance. The importance of analyzing the oxidation behaviour of these thin films lays on the fact that usually, bulk intermetallics show different oxidation rates compared to those of thin films and therefore, new studies in the aforementioned intermetallic system are needed.

Keywords
RuAl
thin films
oxidation
diffusion barrier