

An analytical approach to the β -phase coarsening behaviour in a thermally sprayed CoNiCrAlY bond coat alloy

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Abstract

This paper investigates the β -phase coarsening behaviour during isothermal heat treatment of free-standing CoNiCrAlY (Co-31.7%Ni-20.8%Cr-8.1%Al-0.5%Y, all in wt%) coatings prepared by high velocity oxy-fuel (HVOF) thermal spraying. The microstructure of the coatings was characterised using scanning electron microscopy with energy dispersive X-ray (EDX) analysis and electron backscatter diffraction (EBSD). It comprises a two phase structure of fcc γ -Ni matrix and bcc β -NiAl precipitates. The volume fraction of the γ -Ni and the β -NiAl phases were measured to be around 70% and 30% respectively, with grain sizes varying largely from 0.5 to 2 μm for both phases. Isothermal heat treatments of the free-standing coatings were carried out at 1100 °C for times up to 250 h. The β -phase coarsening behaviour during isothermal heat treatments was analysed by quantitative metallography. It is shown that the coarsening behaviour of β phase in the CoNiCrAlY alloy followed the classical Lifshitz-Slyozov-Wagner (LSW) theory of Ostwald ripening. By incorporating a dimensionless factor which correlates with volume fraction of the β phase, a modified LSW model coupled with formulaic interfacial energy and effective diffusion coefficient of the

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