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ABSTRACT:

Diffusion mechanism and point defect contributions to the growth of Pt/Pd modified (β -NiAl) bond coat on Ni-based superalloy

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The microstructure of a bond coat–superalloy system is a critical factor that influences its performance by high-temperature applications. In this presentation, the complex microstructure is analysed by breaking down the problem into smaller components. Specifically, experiments are designed to estimate the diffusion coefficients in multicomponent β -Ni(Pt/Pd)Al alloys. The results indicate that Pt increases the diffusion rates while Pd has a negligible influence on Ni-Al interdiffusion. Ab-initio based defect analysis supports the triple defect diffusion mechanism dominating over the thermodynamic driving force in this system. With this fundamental analysis, we explain the evolution of the interdiffusion zone between the bond coat and superalloy. The TCP-precipitates grown in the interdiffusion zone are examined in detail using high-resolution TEM and APT providing a complete view on the developed sophisticated microstructure.

1. N. Esakkiraja, A. Gupta, V. Jayaram, T. Hickel, S.V. Divinski, A. Paul, Diffusion, defects and understanding the growth of multicomponent interdiffusion zone between Pt-modified B2 NiAl bond coat and single crystal superalloy, *Acta Materialia* 195 (2020) 35-49.
2. T. Baskaran, N. Esakkiraja, C. Samartha, P. Kumar, V. Jayaram, A. Paul, Effect of addition of Pt, Pd and Ir to β -NiAl-bond coat on oxidation resistance and growth of interdiffusion zone, *Surface and Coatings Technology* 426 (2021)127766.

3. N. Esakkiraja, A. Vishvakarma, S.K.Makineni, V. Jayaram, T. Hickel, S.V. Divinski, A. Paul, Diffusion and defects to evaluate growth behaviour of interdiffusion zone between Pt/Pd-modified B2 NiAl bond coat and CMSX-4 superalloy, under preparation (2023)