

THE ROLE OF SN IN THE OXIDATION OF NB SILICIDE BASED ALLOYS

Zhen Xu, Department of Materials Science and Engineering, The University of Sheffield, UK
z.xu@sheffield.ac.uk

Claire Utton, Department of Materials Science and Engineering, Univ. of Sheffield, UK
Nikos Vellios, Department of Materials Science and Engineering, Univ. of Sheffield, UK
Ioannis Papadimitriou, Department of Materials Science and Engineering, Univ. of Sheffield, UK
Jiang Zhao, Department of Materials Science and Engineering, Univ. of Sheffield, UK
Panos Tsakirooulos, Department of Materials Science and Engineering, Univ. of Sheffield, UK

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Aero-engine materials used in critical components must have acceptable oxidation behaviour at the temperatures of service. Niobium silicide based alloys have the potential to replace Ni based superalloys in future aero-engines owing to their lower densities, higher melting points and balance of properties. Niobium silicide based alloys must have inherent oxidation resistance to survive in case of coating failure

Great advances have been made towards improving the oxidation behaviour of developmental Nb silicide based alloys. Tin was reported [1, 2] to improve oxidation and subsequent research [3, 4] confirmed that Sn as an alloying addition contributes towards suppressing pest oxidation and is an essential alloying addition for suppressing the spallation of scale at high temperatures [5]. Evidence for the enrichment of the microstructure below the alloy/scale interface with Sn was provided for the first time by the group [3, 4]. "How Sn manages to deliver" better oxidation behaviour in Nb silicide based alloys was not understood. In the last "beyond the Ni superalloys" ECI conference some preliminary results were presented in a poster addressing this point.

This presentation will be based on the results of recently completed systematic experimental and modelling research of model alloys and ternary systems to show how Sn affects microstructure and oxidation behaviour. Particular emphasis will be given to the links between phase stability, volume fraction and distributions of key intermetallic phases in the microstructure of Sn containing Nb silicide based alloys and their oxidation at 800 and 1200 °C. The role of Sn for the microstructure at the alloy/scale interface will be discussed.

[1]. M R Jackson, B P Beway, J-C Zhao, US patent, 6,419,765, July 16, 2002

[2]. M R Jackson, B P Beway, J-C Zhao, US patent, 6,913,655, July 5, 2005

[3]. Jie Geng, Panos Tsakirooulos, Guosheng Shao, Intermetallics 15 (2007) 270-281

[4]. Nikos Vellios, Panos Tsakirooulos, unpublished research, 2007

[5]. Jiang Zhao, Panos Tsakirooulos, unpublished research, 2015