

DSL2023

HERAKLION, CRETE | GREECE

26 - 30 JUNE 2023

ABSTRACT:

Effect of Tantalum on Interdiffusion and Oxidation of β -based Titanium Aluminide

Shivansh Mehrotra and Sangeeta Santra

Department of Materials Engineering, Indian Institute of Technology, Delhi, India

The talk will discuss the beneficial role of tantalum (Ta) in the β -based (Ti, Al) solid solution phase with a focus on oxidation and interdiffusion behaviour. A systematic pseudo-binary diffusion study has established that an increase in the Ta content in β -(Ti, Al) decreases the interdiffusion coefficient in the temperature range of 1000-1200 °C. The decrease in the interdiffusion coefficient has been rationalized considering the estimated change in the defect kinetics in the Ta-alloyed β -phase and the thermodynamic driving forces. Furthermore, Ta-alloyed β -phase exhibits an enhanced oxidation resistance by suppressing the growth of porous and non-adherent oxide phase, rutile (TiO₂). Suppression of TiO₂ has been attributed to the increase in the formation energy of oxygen vacancies in TiO₂ with the addition of Ta estimated using the density functional theory (DFT). Oxidation mechanism of Ta-alloyed β -(Ti, Al) phase has been delineated based on the evolution of phases as examined using the electron probe micro analyzer and electron backscatter diffraction techniques.