ADDITION OF PGMS TO IMPROVE HIGH TEMPERATURE OXIDATION RESISTANCE OF TITANIUM-ALUMINIUM ALLOYS

Hadio Mantyi, School of Chemical and Materials Engineering and DST-NRF Centre of Excellence in Strong Materials, University of the Witwatersrand, Johannesburg, South Africa
Hadio.Tsotetsi@students.wits.ac.za
Alain Mwamba, Advanced Materials Division, Mintek, Randburg, South Africa, School of Chemical and Materials Engineering and DST-NRF Centre of Excellence in Strong Materials, University of the Witwatersrand, Johannesburg, South Africa
Lesley Chown, School of Chemical and Materials Engineering and DST-NRF Centre of Excellence in Strong Materials, University of the Witwatersrand, Johannesburg, South Africa
Elma van der Lingen, formerly Mintek, now at Department of Engineering and Graduate School of Technology Management, Engineering, University of Pretoria, South Africa
Lesley Cornish, School of Chemical and Materials Engineering and DST-NRF Centre of Excellence in Strong Materials, University of the Witwatersrand, Johannesburg, South Africa

Key Words: Corrosion, platinum group metal additions, Ti-Al

Ti-Al alloys have the potential to be used more widely in aerospace applications, but their main problems are poor ductility at room temperature and low oxidation resistance above 800°C. In an effort to improve these properties, two approaches are being used to ascertain the effects of different alloying additions on the oxidation resistance, and to attempt to improve the ambient hardnesses, as an indication of the mechanical properties.

The mining industry in South Africa, a major source of platinum group metals (PGMs), is seeking to expand the uses of these metals. As PGMs are relatively oxidation resistant, the first approach was to add 0.2, 1.0, 1.5 or 2.0 at.% platinum, palladium, ruthenium or iridium to 47.5 at.% Al TiAl. In the second approach, 10 at.% nickel, with or without 0.2 at.% ruthenium, was added to 52.5 at.% Al TiAl.

The alloys were cast in a button arc furnace. Samples were prepared metallographically, then analysed using SEM-EDX and XRD. Thermogravimetric analyses were done in air up to 1050°C, and isothermal oxidation tests were done in air at 950°C for 120 and 720 hours. After the oxidation tests, the samples were sectioned and analysed using SEM-EDX.

This work seeks to explain the different effects of the alloying additions in the two series of alloys by comparing the microstructure, mass change and mechanical properties.