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Oxidation behavior of protective Ti-Al-Cr based coatings applied on the γ -TiAl alloys Ti-48-2-2 and TNM-B1

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Abstract:

Intermetallic Ti-Al-Cr based coatings with small additions of yttrium or zirconium were deposited on the γ -TiAl alloys Ti-48-2-2 and TNM-B1 using magnetron sputtering. The oxidation behavior of the coated substrates was investigated in the temperature range between 850°C and 950°C under cyclic thermal exposure conditions in laboratory air. Excellent oxidation protection to both TiAl alloys was provided by the Ti-Al-Cr-Y coating in the studied temperature range for up to 1000 1h-cycles. Similar results were obtained for the Ti-Al-Cr-Zr coating on the Ti-48-2-2 substrate. When thermally cycled at 900°C and 950°C, the latter protective layer deposited on the TNM-B1 alloy locally degraded probably caused by cracks in the coating leading to substrate oxidation. During high temperature exposure the microstructure of the coatings changed due to depletion in Al and Cr. Because alloy Ti-48-2-2 contains 2 at.% Cr and has a higher Al content compared to the TNM-B1 alloy, interdiffusion between coating and the Cr bearing substrate is reduced, retarding phase transformation in the oxidation protective layers.

Keywords:

Titanium aluminides, intermetallic Ti-Al-Cr based coatings, magnetron sputtering, oxidation protection, phase formation,

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