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Influence of magnetron sputtered ZrO2-4mol%Y2O3 thermal barrier coatings on the high temperature oxidation behaviour of γ-TiAl based Ti-45Al-8Nb alloy

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In the field of aerospace and automotive industry the development of light materials with resistance against high mechanical stresses is a main focus especially for economic and ecological reasons. Offering much lower density and excellent mechanical properties γ-TiAl based alloys are promising candidates to replace the heavy steels and Ni-base super alloys. In accordance with the application of thermal barrier coatings on the heavy materials used so far, the development of such protective layers on γ-TiAl is necessary to exploit the full potential of these light weight structural materials in the temperature range of 800 – 950°C.
In this study the influence of partially yttria stabilized zirconia (ZrO_2-4mol%Y_2O_3) coatings on the high temperature oxidation resistance of Ti-45Al-8Nb (at.%) was investigated. By using the electron beam physical vapour deposition process for layer deposition previous analysis revealed different growth morphologies of the oxide scale at the oxide/coating interface as compared to oxide scale formation on bare material, which presumably were caused by the columnar structure of the thermal barrier coating. In comparison, a dense ZrO_2-4mol%Y_2O_3 layer was deposited by using RF magnetron sputtering for closer understanding of the oxide formation process. The coating systems were tested in laboratory air at 950°C under thermo-cyclic conditions. After 5, 10 and 50 1h-cyles exposure the microstructural evolution was analyzed by XRD as well as analytical SEM and TEM investigations.

Keywords
magnetron sputtering
thermal barrier coating
oxidation
TiAl