A microstructural study of the early-stage high-temperature steam oxidation behavior of γ-TiAl alloy

Chi Xu[1,2], Wenbin Xue[1,2]

[1]*Key Laboratory of Beam Technology of Ministry of Education, College of Nuclear Science and Technology, Beijing Normal University, Beijing 100875, China*

[2]*Institute of Radiation Technology, Beijing Academy of Science and Technology, Beijing 100875, China*

xuchi@bnu.edu.cn

Abstract A microstructural characterization of the early-stage steam oxidation behaviors of a γ-TiAl alloy was performed. The γ-TiAl alloy samples were oxidized in water steam at 900, 1000, 1100, and 1200°C for 1 h. The steam oxidation dynamic curves were compared. Multiple characterization techniques, including the XRD, SEM and TEM coupled with EDXS, and GDOES were employed to analyze the microstructures induced by the high temperature steam environment at different temperatures. Multilayered structures were formed. A compact Ti_3Al layer was formed next to the TiAl substrate. An outer layer of TiO_2 and Al_2O_3 mixed oxides was observed, where the oxide grains are transferred from long-columnar grains at 900°C to the randomly scattered grains at 1200°C. The ribbon shaped Al_2O_3 grains extend inward into the Ti_3Al layer at 1100°C and above. An intermediate layer with dark speckles and bright background was formed at 1200°C. Fine pores existed in the near-surface areas of the oxide scales for all specimens. The mechanisms for the steam oxidation induced microstructures, water vapour and the temperature effects were discussed in details.

Keywords TiAl alloy; High-temperature steam oxidation; TEM characterization; GDOES; XRD

Reference

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