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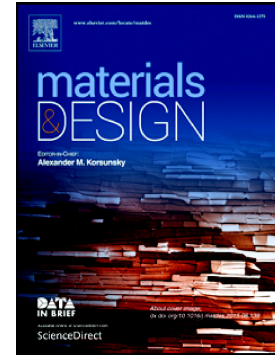
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# Interactions between Nb-Si based ultrahigh temperature alloy and yttria matrix mould shells

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**Abstract:** To find the best mould shells for investment casting of Nb-Si based ultrahigh temperature alloy,  $Y_2O_3$  mould shells with zirconia face coat and yttria face coats doped with  $CaO+ZrO_2$ ,  $MgO+ZrO_2$ ,  $La_2O_3+ZrO_2$  and  $CeO_2+ZrO_2$  oxides were prepared and their interactions with the melt of the alloy at 1850 °C for 30 min were investigated. The results show that the interfaces between the alloy and the mould shells with yttria face coats doped with  $CaO+ZrO_2$ ,  $MgO+ZrO_2$  and  $La_2O_3+ZrO_2$  oxides during re-melting process all comprise two types of reaction layers, which are mainly composed of  $HfO_2+Y_2O_3$  and  $TiO+HfO_2$ . The interface between the alloy and the mould shell with yttria face coats doped with  $CeO_2+ZrO_2$  is also composed of two types of reaction layers, which consist of  $HfO_2+Y_2O_3$  and cubic  $HfO_2$  respectively. A single reaction layer consisting of  $HfO_2+Y_2O_3$  constitutes the interface between the alloy and the pure yttria mould shell, and the interface between the alloy and the mould shell with zirconia face coat is also composed of a single reaction layer but consisting of cubic  $HfO_2$ . Both pure yttria and the yttria doped with  $La_2O_3+ZrO_2$  mould shells are more suitable for the investment casting of the alloy.

Keywords: Nb-Si based ultrahigh temperature alloy; Yttria matrix mould shell; Interaction; Investment casting

## 1 Introduction

Nb-Si based ultrahigh temperature alloys, which possess certain room temperature fracture toughness, excellent high temperature strength, comparatively low density and high melting point, have drawn considerable attention as potential alternative materials for turbine blades working at temperatures around 1200-1400 °C [1-3]. However, owing to the high brittleness and stiffness of intermetallic  $Nb_5Si_3$

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