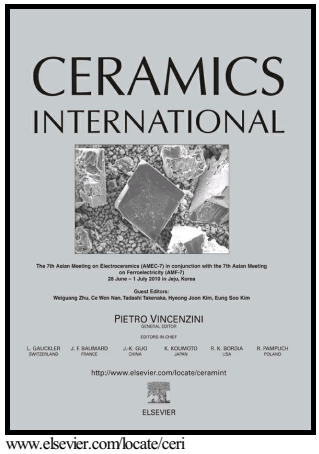

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Experimental investigations and thermodynamic calculations of the interface reactions between ceramic moulds and Ni-based single-crystal superalloys: Role of solubility of Y in the $LaAlO_3$ phase

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Abstract: It is commonly recognised that more reactive elements contained in Ni-based superalloy result in more-severe interfacial reactions, and thus more inclusions formed at the interface. However, the present work revealed that with rare-earth elements, specifically 0.24 wt.% La+Y added to Ni-based superalloys, the interfacial reaction (~5 μm in thickness) between the ceramics and metal was retarded compared to the case of 0.12 wt.% Y (~10 μm in thickness). Scanning electron microscopy, focused ion-beam transmission electron microscopy, and X-ray photoelectron spectroscopywere used to characterise the microstructure at the interface. Thermodynamic calculations of the Gibbs free energies of interfacial reactions were conducted. Experimental and theoretical results show that the solubility of Y in the $LaAlO_3$ phase (>3.4 at.%) hinders interfacial reactions.

Keywords: Ceramic mould; Ni-based superalloys; Interfacial reaction; Rare-earth elements; Thermodynamic calculations