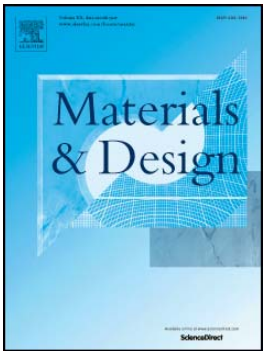

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Development of tool for physical simulation of skin formation during investment casting of Nickel-based superalloys

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Abstract

Development of investment casting process has been always a challenge for manufacturers of complex shape parts with thin elements. Particularly, misruns often occur in the as-cast complex shape parts due to formation of solid skin by freezing of melt in contact with colder ceramic mould. This work presents a new tool for physical simulation of skin formation during investment casting. Special ceramic tubes are designed and fabricated from the material used for manufacturing of ceramic moulds for investment casting. Melting/solidification experiments are carried out in the thermo-mechanical simulator, where the melt is contained in the ceramic tube, which is heated to the temperature of ceramic mould in investment casting. Detailed microstructural characterization of the solidified specimens is performed; the obtained results predict the thickness of skin and its microstructure. This concept is applied to investment casting of complex shape nozzle guide vanes from the Mar-M247 Ni-based superalloy. Experimental casting trials are performed, and the outcomes of physical simulation tool are validated against experimental results.

Keywords: physical simulation, investment casting, superalloy, skin, microstructure

1. Introduction

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