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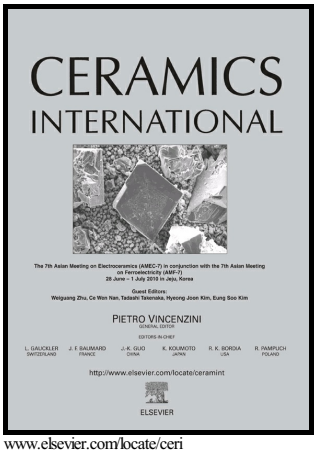
Y. Venkat, Sarabjit Singh, D.K. Das, A.K. Pandey



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Effect of fine alumina in improving refractoriness of ceramic shell moulds used for aeronautical grade Ni-base superalloy castings

Y. Venkat[*1], Sarabjit Singh[1], D.K. Das[1] and A.K. Pandey[2]

[1]Defence Metallurgical Research Laboratory, P.O. Kanchanbagh, Hyderabad-500058, India

[2]National Institute of Technology, Warangal-506004, Telangana, India

*Correspondence to: Tel.: +91-40-24586594; Fax: +91-40-24343006. vyakatpure@dmrl.drdo.in; vyakatpure@yahoo.co.in

Abstract

This paper discusses an improvement in shell refractoriness and dimensional stability of columnar grained (CG) low pressure turbine blade castings made using Ni base superalloy by directional solidification process (DS). Two ceramic shell systems were adopted, namely shell system I and II. Shell moulds were prepared by using ceramic slurries containing zircon flour as a filler material and colloidal silica as a binder. As compared to shell system II (zircon filler with colloidal silica binder and fine alumina), shell system I (zircon filler with colloidal silica binder) showed lower refractoriness. Shell system II showed an increase in the flexural strength both in the green as well as in fired conditions. Shells made from shell system II showed about 13% higher green strength and 55% higher fired strength as compared to shell system I. Shell system II also exhibited superior self sag resistance up to 1625°C. Moulds prepared from this shell system yielded aeronautical grade casting with high dimensional accuracy even at a metal pouring temperature of 1550°C. Moulds from shell system I, on the other hand, underwent sagging even at metal pouring temperature of 1500°C, leading to dimensionally unacceptable castings. The superior performance of shells prepared from shell system II can be ascribed to the presence of fine alumina in the shell.