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Effect of Chilling on Soundness, Micro Hardness, Ultimate Tensile Strength, and Corrosion Behavior of Nickel Alloy-Fused Silica Metal Matrix Composite

Authors : G. Purushotham, Joel Hemanth

Abstract : An investigation has been carried out to fabricate and evaluate the strength and soundness of chilled composites consisting of nickel matrix and fused silica particles (size 40–150 μm) in the matrix. The dispersoid added ranged from 3 to 12 wt. % in steps of 3%. The resulting composites cast in moulds containing metallic and non-metallic chill blocks (MS, SiC, and Cu) were tested for their microstructure and mechanical properties. The main objective of the present research is to obtain fine grain Ni/SiO2 chilled sound composite having very good mechanical properties. Results of the investigation reveal the following: (1) Strength of the composite developed is highly dependent on the location of the casting from where the test specimens are taken and also on the dispersoid content of the composite. (2) Chill thickness and chill material, however, does significantly affect the strength and soundness of the composite. (3) Soundness of the composite developed is highly dependent on the chilling rate as well as the dispersoid content. An introduction of chilling and increase in the dispersoid content of the material both result in an increase in the ultimate tensile strength (UTS) of the material. The temperature gradient developed during solidification and volumetric heat capacity (VHC) of the chill used is the important parameters controlling the soundness of the composite. (4) Thermal properties of the end chills are used to determine the magnitude of the temperature gradient developed along the length of the casting solidifying under the influence of chills.

Keywords : metal matrix composite, mechanical properties, corrosion behavior, nickel alloy, fused silica, chills
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