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The effect of nanoparticles addition to molten A356, is it a refining or strengthening effect?

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Abstract

The effect induced by adding Al2O3 nanoparticles reinforced to semisolid cast Hypo and Hyper-eutectic Al-Si alloys is continually reported to show the enhancement in the mechanical properties. The experimental results show a strengthening effect associated with an increase in ductility/ and or toughness, induced by adding nano-reinforcements.

The aim of this work is to add a contribution towards understanding the strengthening effect observed in nanoparticles-reinforced A356 alloy. This is done by calculating the conventional incremental summation of several strengthening mechanisms contributing to strengthening and reinforcement in composites. The results obtained by applying the mathematical calculations are compared with the experimental results reported from the literature.

Based on the mathematical approach, this work shows that the main strengthening mechanisms acting for MMNCs are those contributing to the strengthening of the matrix. These result from contributions by Orowan strengthening and CTE and EM mismatch.

Keywords: Nano-reinforced A356; Cast MMNCs; Strengthening mechanisms.