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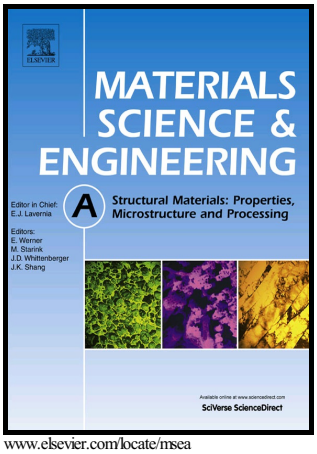

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Fabrication, microstructure refinement and strengthening mechanisms of nanosized SiC_P/Al composites assisted ultrasonic vibration

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Abstract

The performances of particulate–reinforced aluminum matrix composites are strongly dependent on alloying elements, precipitates and added particulates. To reveal the sole influence mechanisms of high volume fraction of nanosized particulates on the solidification behavior, microstructure and mechanical properties of aluminum alloys, nanosized SiC_P (60 nm) was incorporated into commercial pure Al at different volume fractions (i.e., 0, 1, 3, 5, 7 and 9 vol.%) by stir–casting assisted ultrasonic vibration. The results reveal that a fairly uniform dispersion of nanosized SiC_P throughout the matrix was achieved at a volume fraction as high as 7 vol.%. Average α–Al dendritic sizes were significantly refined from 270 μm for the matrix to 90 μm in the solidified microstructure of nanocomposites. Thermal analysis during solidification indicates that the presence of nanosized SiC_P increased the nucleation temperature of α–Al, whilst recalescence during solidification process disappeared. Additionally, the yield and ultimate tensile strength of the nanosized SiC_P/Al composites at both ambient