Microstructure evolution of A356 aluminum alloy reinforced with Si₃N₄ particles during mechanical milling

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Nano-composite A356-Si₃N₄ alloys were obtained by co-milling aluminium alloy A356 with different mass fractions (10, 20 and 30%) of Si₃N₄ in a planetary mill. The structural and microstructural modifications at different stages of the mechanical milling were investigated using Scherrer formula and Whole Powder Pattern Modeling (WPPM) of the X-ray powder diffraction (XRPD) pattern. Due to the inhomogeneity of the microstructure of the starting powder and of the milling process, the WPPM of XRPD data required the hypothesis of a multimodal distribution and the coexistence of multiple Al alloy fractions with different Si content. By increasing the milling time and the amount of reinforcing particles, the inhomogeneity decreases and a single lognormal distribution is enough to model the data. The dependence of lattice parameters on the coherent domain (crystallite) size during milling has been investigated. The lattice parameters were calculated in view of the non-equilibrium grain boundary structure that evolved during milling using excess free volume and the interfacial stresses at the grain boundaries.

Recent Publications:

Biography
Heydi Fernandez has her expertise in physico-chemical and structural characterization of materials. She is a regular student of the Science and Engineering Materials PhD program at University of Santiago de Chile (USACH), granted with the National Doctorate Scholarship CONICYT. She is developing her thesis in the area of powder metallurgy, specifically studying the microstructural and mechanical evolution of composites of aluminum alloy A356 reinforced with Si₃N₄. Her has worked with Nanomaterials as sorbent of divalent metal ions and dyes, also in the use of X-ray diffraction techniques and specifically in the microstructural refinement and texture analysis with the PM2K code for WPPM.

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