An X-ray Diffraction Study on Dislocation Microstructure of as-prepared Al-Al_2O_3 Composites

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Particle reinforced MMC of Al - α-Al_2O_3 were prepared in the powder metallurgy route with 20, 50 and 75wt% of Al powder. The line profile analysis of the composites was done in the Whole-Pattern Fitting procedure based on the Rietveld structure refinement codes. It also incorporates the microstructure refinement codes based on either phenomenological parameters [1] or physically based model [2]. Here the microstructures of α-Al_2O_3 containing Al-based composites were studied in terms of ab-initio quasi-composite model of dislocation cell structure [3] and ellipsoidal log-normal distribution of crystallite size.

Postproduction plastic deformation of the Al grains and hence stress relaxation of the composites have taken place during cooling from the sintering temperature (500^oC). It was also noticed that in the composites with lower concentration Al, each reflection of Al could be fitted with two peaks indicating dissimilar fragments with different dislocation density and arrangements. The region of high ($\sim10^{10}$ cm^{-2}) and low ($\sim10^9$ cm^{-2}) dislocation density has been characterized as cell walls and cell interiors respectively with compressive and tensile stresses in accordance with the quasi-composite model. The results are in gross agreement with earlier TEM studies.

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