

Microstructure and Mechanical Evaluation of PMMA/Al₂O₃ Nanocomposite Fabricated via Friction Stir Processing

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Abstract : This study aims to produce a polymer matrix composite reinforced with Al₂O₃ nanoparticles in order to enhance the mechanical properties of PMMA. The composite was fabricated via Friction stir processing to ensure homogenous dispersion of Al₂O₃ nanoparticles in the polymer, and the processing was submerged to prevent the sputtering of nanoparticles. The surface quality, microstructure, impact energy and hardness of the prepared samples were investigated. Good surface quality and dispersion of nanoparticles were attained through employing sufficient processing conditions. The experimental results indicated that as the percentage of nanoparticles increased, the impact energy and hardness increased, reaching 2 kJ/m² and 14.7 HV at a nanoparticle concentration of 25%, which means that the toughness and the hardness of the polymer-ceramic produced composite is higher than unprocessed PMMA by 66% and 33% respectively.

Keywords : friction stir processing, polymer matrix nanocomposite, mechanical properties, microstructure

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