EFFECT OF POLARIZATION ON FRACTURE TOUGHNESS OF $BaTiO_3/Al_2O_3$ COMPOSITES

Sirirat Rattanachan[a] Yukio Miyashita[b], Yoshiharu Mutoh[b]

[a]Institute of Engineering, Suranaree University of Technology, 111 University Avenue, Nakhon Ratchasima 3000, Thailand

[b]Department of Mechanical Engineering, Nagaoka University of Technology, 1603-1 Kamitomioka, Nagaoka-shi 940-2811, Japan

Abstract

In this study, Al_2O_3 based composites dispersed with $BaTiO_3$ particles were fabricated by a conventional sintering process. The relative density and microstructure (grain size, phase) of composites were studied. The relative density of $BaTiO_3/Al_2O_3$ composites decreased with increasing $BaTiO_3$ content, and there were reaction phased between Al_2O_3 matrix and dispersed $BaTiO_3$ particles. The Indentation Fracture Method was used to evaluate the fracture toughness of the present composites before and after polarization. It was verified that an applied electric field induced distinct anisotropy in fracture toughness of $BaTiO_3/Al_2O_3$ composites between parallel and perpendicular directions to the poling direction. The fracture toughness was improved with addition of $BaTiO_3$ particles to Al_2O_3 matrix. The toughening mechanisms of $BaTiO_3/Al_2O_3$ composites have been also discussed.

Keywords: Al_2O_3; $BaTiO_3$; Composites; Ferroelectric properties; Fracture toughness; Piezoelectric properties; Polarization

Published in: Journal of the European Ceramic Society 24 2004: pp.775-783.