Estimation of Fracture of Magnesia Particulates in Its Metal Matrix Composites

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ABSTRACT

The metal matrix composites (MMCs) being of very high interest for the aerospace industry, particularly to build up thermal-structural components, it is important to have available technique which are easy and simple to conduct for characterization of the mechanical strength of the material. In the past, various research works have been carried out on metal matrix composites prepared from aluminum alloy matrices and reinforced particles such as SiC, Al_2O_3, TiO_2, MgO, TiN, B_4C, TiB_2, $Al(OH)_3$ and graphite. The stress transfer characteristic of nanoparticle reinforced composite materials under various mechanical and thermal loadings is very important for optimum utilization of metal matrix composites. The characteristics of low density and low thermal expansion of ceramics assume a great deal of importance in most applications. Magnesium oxide (MgO) is also is also known as magnesia. MgO doping has been shown to effectively inhibit grain growth in ceramics and improve their fracture toughness by transforming the mechanism of crack growth at nanoscale. Magnesium oxide is used as an oxide barrier in spin-tunneling devices. MgO is thermally stable up to about 700 K.

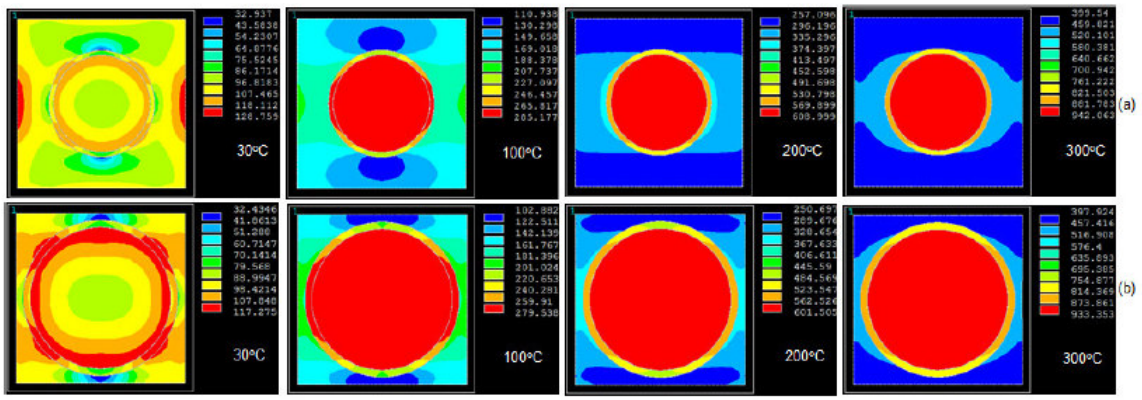

Figure 1: Images of von Mises stresses obtained from FEA: (a) AA8090/10% BN and (b) AA8090/30% BN composites.

In the present work, the AA1100-MgO metal matrix composites were manufactured att 10% and 30% volume fractions of MgO. The composites were subjected to mechanical and thermal loads. The microstructure of AA1100 alloy-MgO reveals the fracture of particle. The particle fracture was initiated at 100oC due to combined thermal and tensile loading.

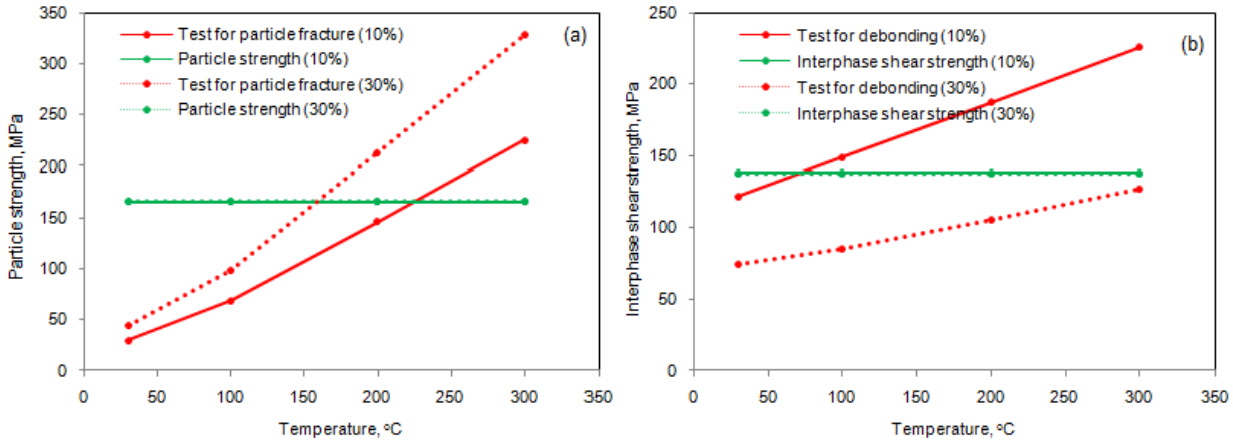

Figure 2: Criterion for interfacial for (a) particle fracture and (b) debonding.

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