

Nanobioceramic composites: a study of mechanical, morphological, and thermal properties

ABSTRACT

The aim of this study was to explore the incorporation of biomass carbon nanofillers (CNF) into advanced ceramic. Biomass from bamboo, bagasse (remains of sugarcane after pressing), and oil palm ash was used as the predecessor for producing carbon black nanofillers. Furnace pyrolysis was carried out at 1000 °C and was followed by ball-mill processing to obtain carbon nanofillers in the range of 50 nm to 100 nm. CNFs were added to alumina in varying weight fractions and the resulting mixture was subjected to vacuum sintering at 1400 °C to produce nanobioceramic composites. The ceramic composites were characterized for mechanical, thermal, and morphological properties. A high-resolution Charge-coupled device (CCD) camera was used to study the fracture impact and the failure mechanism. An increase in the loading percentage of CNFs in the alumina decreased the specific gravity, vickers hardness (HV), and fracture toughness values of the composite materials. Furthermore, the thermal conductivity and the thermal stability of the ceramic composite increased as compared to the pristine alumina.

Keyword: Ceramic composite; Carbon nanofiller; Thermogravimetric analysis; Mechanical properties