

The effect of nano-copper additives on the porosity, mechanical properties, and microstructure of alumina ceramics using commercial rice husk ash as a pore former

ABSTRACT

The aim of the present research is to examine the effect of Cu metal addition in nano-scale particle size on the mechanical properties and porosity of porous alumina ceramics using commercial rice husk ash as pore forming agent and silica (SiO₂) source. Porous alumina ceramics reinforced were prepared using nano-scale Cu metal particles as their strengthening phase. Solid-state and sacrificial techniques were used to prepare the porous alumina reinforced ceramics. A field emission scanning electron microscope (FESEM), X-ray diffraction (XRD), and transmission and electron microscope (TEM) were used to analyze the microstructure and ceramic phases. Different ratios of Cu metal were added (3, 6, 9, and 12 wt%) at different ratios of commercial rice husk ash. The results of this investigation show that with increasing ratios of Cu metal, the porosity decreased and the mechanical properties increased. The increase in the mechanical properties could be attributed to the decrease in the porosity, the toughening mechanism, increase density of porous alumina ceramics, and formation of the tenorite (CuO) phase due to sintering at high temperature (1600 °C). Some potential applications include purging of gas filtration and thermal insulation.

Keyword: Nano-copper; Rice husk ash; Porosity; Mechanical properties; Porous ceramics