

Tensile strength and corrosion resistance properties of porous Al₂O₃/Ni composites prepared with rice husk pore-forming agent

ABSTRACT

The mechanical performance and chemical stability of porous alumina materials operating under harsh service conditions are of utmost importance in understanding their operational behavior if they are to stand the test of time. In the present study, the joint effect of nickel (Ni) reinforcement and rice husk (RH) pore-forming agent (PFA) on the tensile strength and the corrosion resistance properties of composite porous alumina ceramics was studied. To exploit the potential of this new porous alumina system, plain and Ni-reinforced porous alumina samples (Al₂O₃-xNi-RH; x = 2, 4, 6 and 8 wt%) were developed through the powder metallurgy technique. Comprehensive investigation on the tensile strength properties of the developed porous alumina ceramics showed that relative to the plain sample (tensile strength and elastic modulus; 6.1 MPa and 1201 MPa), the presence of highly stable Ni₃Al₂SiO₈ spinelloid promoted the tensile strength enhancement (12.6–6.4 MPa) and the elastic modulus decline (897–627 MPa) of the composite samples. Similarly, corrosion resistance test was performed on the composite porous alumina samples in both 10 wt% NaOH and 20 wt% H₂SO₄ hot aqueous solutions. Overall, the composite samples demonstrated superior chemical stability in NaOH solution as compared with the plain sample. On the other hand, the composites were more prone to attack in H₂SO₄ solution, except for the Al₂O₃-2Ni-10RH composite sample which maintained its superiority over the plain counterpart.

Keyword: Porous alumina; Composites; Rice husk; Mechanical properties; Corrosion resistance