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Alumina-based nanocomposites using graphite nanoplatelets as reinforcement

Syed Nasimul Alam and Nidhi Sharma

National Institute of Technology Rourkela, India

Graphene has outstanding mechanical properties and unique electrical and thermal properties which makes it an attractive filler and a good reinforcement for producing multifunctional ceramics for a wide range of applications. Here, alumina (Al_2O_3) based nanocomposites have been developed using exfoliated graphite nanoplatelets (xGnP) as reinforcement. The xGnP were synthesized by subjecting a graphite intercalation compound (GIC) to a thermal shock. The Al_2O_3 and xGnP powders were mixed by milling them for a short period of time in order to ensure homogeneous distribution of xGnP in the Al_2O_3 matrix. Al_2O_3 -0.2, 0.5, 0.8, 3 and 5 vol. %xGnP nanocomposites were developed by powder metallurgy route. Sintering was done by conventional sintering process. The hardness, fracture toughness and tribological properties of the composites having different vol. %xGnP loading were investigated. Results show a significant improvement in the wear resistance of the Al_2O_3 -xGnP composites having more than 0.8 vol. %xGnP loading. The improvement in mechanical properties is attributed to the uniform dispersion of xGnPs and toughening mechanism such as xGnP bridging, crack deflection and strong interaction between xGnP and Al_2O_3 at the interfaces. Results of the dry sliding wear tests of the composites with different vol. %xGnP loading suggest a significant improvement in the wear resistance of the composites upto the addition of 3 vol. %xGnP. The hardness of the composites also show a gradual increase upto the addition of 3 vol. %xGnP beyond which there is a deterioration in both the hardness and the wear properties.

Biography

Syed Nasimul Alam received his BTech degree from Indian Institute of Technology, Kharagpur, India in Metallurgical and Materials Engineering. He did his MS in Photonics and Electronic Materials in Chemical and Nuclear Engineering Department at University of Massachusetts, Lowell, USA. He did his PhD in the Department of Metallurgical and Materials Engineering, Indian Institute of Technology Kharagpur, India in the field of Mechanical Alloying. He is currently an Assistant Professor at National Institute of Technology Rourkela, India. His major interests are nanomaterials and nanocomposites. He has published more than 20 papers in reputed journals and has published two books on MATLAB.

nasimulalam@yahoo.com

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