Effect of silicon carbide particles on the microstructure and tribological behaviour of functional graded Al/SiCp composites

A.C. Vieira[a*], L.A. Rocha[a], J.R.Gomes[(a)]
[(a)]Research Centre on Interfaces and Surfaces Performance, Department of Mechanical Engineering, University of Minho, 4800-058 Guimarães, Portugal
**catarina.vieira@engmateriais.eng.uminho.pt*

ABSTRACT

Aluminium matrix composites have been wide used essentially due to the good relation between weight and mechanical resistance. Also, the additions of ceramic reinforcement, mainly SiC particles, improve some properties of these composites, particularly wear resistance. Additionally, when functional gradients of properties are promoted in this type of composites, a wide range of properties are improved. This type of materials could be used as tribomaterials of high potential for automotive and aeronautic industries, particularly in applications such as cylinder liners, valves and came followers. In those situations a tribological system is created.

In this work, the influence of the incorporation of SiC_p on the microstructure of the Al matrix (Al-10Si-4,5Cu-2Mg) processed by centrifugal casting was evaluated by comparing the unreinforced alloy, in which a graded microstructure is present, with that obtained in the functionally graded Al-alloy composite reinforced with SiC_p. The volume fraction of SiC particles in the precursor composite was 10%. Additionally, the tribological behaviour of the two materials was evaluated and compared in order to estimate how the changes in microstructure promoted by SiC_p addition would influence the tribological response. Unlubricated tribological tests were performed in a pin-on-disc tribometer where the normal load, frequency and linear velocity were kept constant (3 N, 1 Hz, 0.5 m/s respectively). As conterbody an AISI 52100 steel was used.

The microstructures and the wear mechanisms were identified by SEM/EDS analysis. Worn surfaces were also characterised by AFM. Results show that some extreme fatigue and abrasion phenomena dominate the wear mechanisms presented in this type of materials. However, the tribological response appears to be strongly influenced by the volume fraction of reinforcing particles. Also, the role of the matrix microstructure on the tribological behaviour, essentially in what concerns to the particles/matrix interfacial region is discussed.