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Aluminium Matrix Composites (AA6061/$CaSiO_3$) Fabricated by Powder Metallurgy

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There is an increasing interest in developing Aluminium Matrix Composites (AMCs), which are commonly used in components for the aerospace and automotive industries [1-3]. The AMCs components show a high strength/weight ratio, good mechanical properties, and higher durability due to the addition of particles as reinforcements [1,2]. The present work will focus on the fabrication of AMCs composed of AA 6061 alloy with particles of $CaSiO_3$ (wollastonite) used as reinforcement. Powder metallurgy is widely used to control the dispersion of particles in AMCs [3]. The present work aims to study the influence of powder metallurgy technique in the fabrication of AMCs of AA6061 /$CaSiO_3$ with different contents of $CaSiO_3$ on the microstructure of the alloy matrix by optical microscopy (OM), scanning electron microscopy and energy-dispersive X-ray spectroscopy (SEM / EDS).

The AMCs were prepared by powder metallurgy. Mechanically roughing AA 6061 alloy particles were used to prepare AMCs. The $CaSiO_3$ contents used as reinforcement were 5 and 10 wt %, respectively. AA 6061 powders, $CaSiO_3$ and zinc stearate, were mixed for 15 min in a mortar and after, in a vortex set for 15 min more. Subsequently, uniaxial pressing was used to obtain AMCs green compacts with a load of 3.6 tons and 5 minutes as holding time. Following, the green compacts sintering in N2 atmosphere, with a heating rate of 10 ° C / min to 580 ° C for 50 minutes and cooled down in a furnace. The metallographic preparation of the specimens consisted of roughing and polishing to study their microstructure.

The typical microstructure of the AA6061/$CaSiO_3$ composites is observed in figure 1a, which shows a homogeneous dispersion of $CaSiO_3$ particles. The surface of the AA6061/$CaSiO_3$ composites with 5 and 10% of $CaSiO_3$ is observed in figure 1b-d. These images show some typical features of these materials, such as porosity and the agglomeration of finer $CaSiO_3$ particles promoting this porosity. The homogeneity of the composite is shown in the elemental X-ray map in figure 2 and confirms some agglomeration of $CaSiO_3$ particles. The results would indicate that the powder metallurgy technique can be used effectively to fabricate AA6061/$CaSiO_3$ composites.

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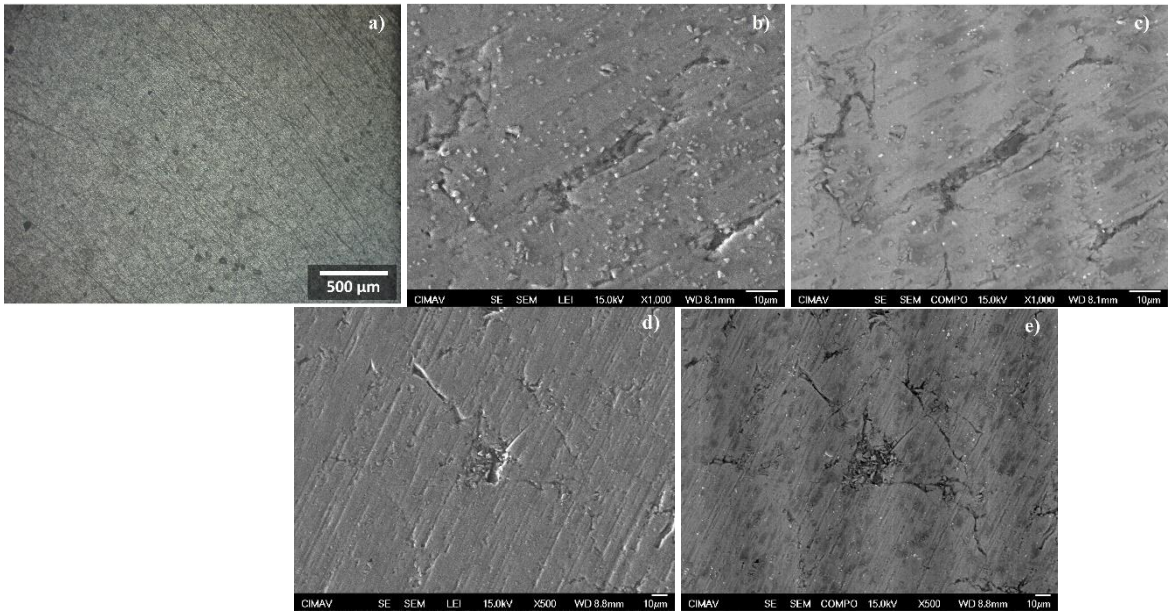

Figure 1. AA6061/$CaSiO_3$ composites typical microstructures at different $CaSiO_3$ content, a) Optical image, X50, b) SE image of specimen with 5 %, c) BSE image of specimen with 5 %, d) SE image of specimen with 10 % c) SE image of specimen with 10 %.

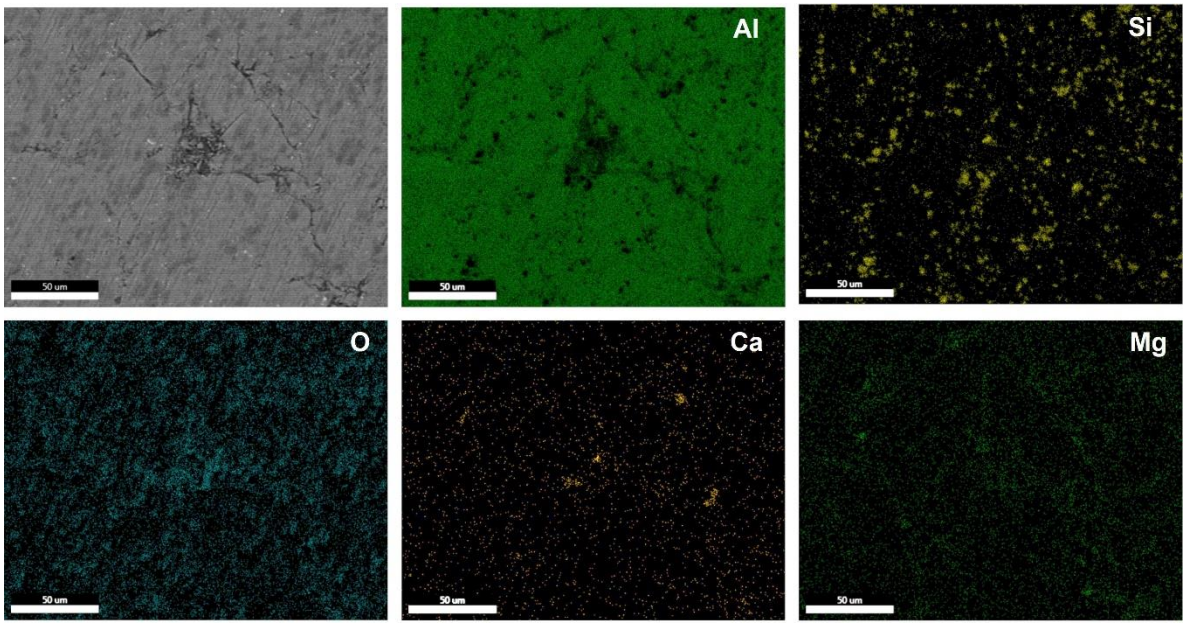

Figure 2. BSE image and elemental X-ray map of the contents of the AA6061/CaSiO3 composite with 10 % CaSiO3.

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