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

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Aluminum matrix composite materials (AMCs) are widely used in components for the aerospace and automotive industries [1]. These compounds show a high strength/weight ratio, good mechanical properties and greater durability due to the addition of particles as reinforcements [1,2]. The present work will focus on the study of the reinforcement of AA 6061 alloy with particles of $CaSiO_3$ (wollastonite). Powder metallurgy is widely used to control the dispersion of particles in AMCs [3,4]. The present work aims to study the influence of different contents of $CaSiO_3$ on the microstructure of the alloy matrix and the effect of the powder metallurgy technique by optical microscopy (OM), scanning electron microscopy and energy dispersive X-ray spectroscopy (SEM / EDS).

The preparation of the AMCs was performed by conventional powder metallurgy. AA 6061 aluminum alloy particles obtained by friction were used (figure 1). The $CaSiO_3$ contents used as reinforcement were 0.5, 1.0 and 1.5. wt % respectively. AA 6061 powders, wollastonite and zinc stearate, were screened using an 80 mesh, after mixing in a vortex set for 15 min. Subsequently, uniaxial pressing was used to obtain compacts of AMCs using 3.4 tons for 5 minutes. Then, the (green) compacts were sintered in N_2 atmosphere, heating 10 ° C / min to 580 ° C for 40 minutes and cooled down in the oven. A metallographic preparation was made consisting of roughing and polishing to study its microstructure.

Figure 1 shows, the mixed powders after uniaxial pressing (greens) and the same samples after sintering. The SEM images (figure 2) show the typical microstructures of the sintered AMCs at different compositions of $CaSiO_3$. All the samples depicted some porosity and according to BSE images and EDS analyses the dark grey areas at grain boundaries in figure 3a corresponded to the composition of Al_2O_3 with $CaSiO_3$, bright contrast particles were found to be Fe-rich oxide as contaminant from the friction tool used to obtain AA6061 powders.

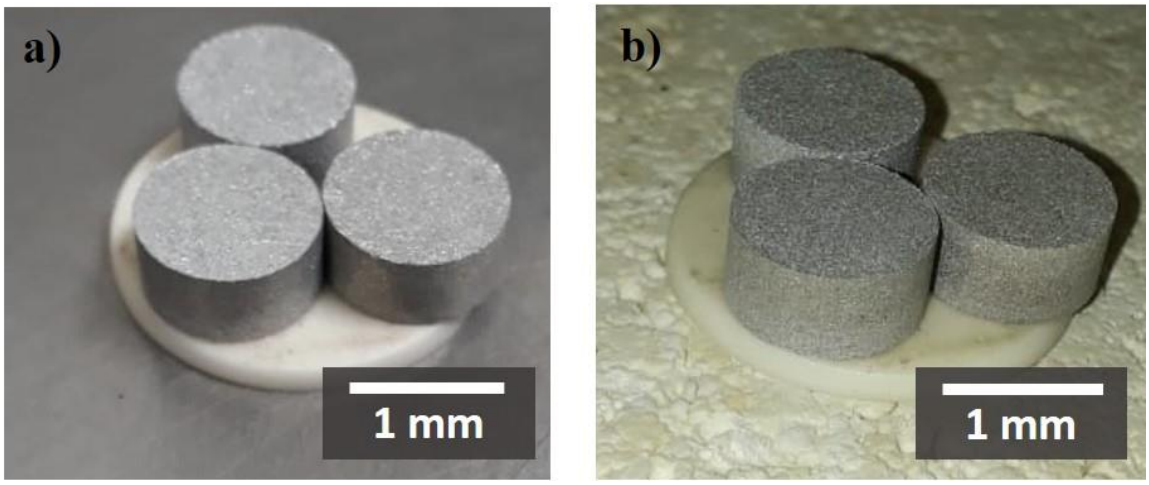

Figure 1. Aluminium Matrix Composites 6061/CaSiO3, a) Green compacts after uniaxial pressing b) Sintered compacts a 580 °C for 40 min in N2 atmosphere.

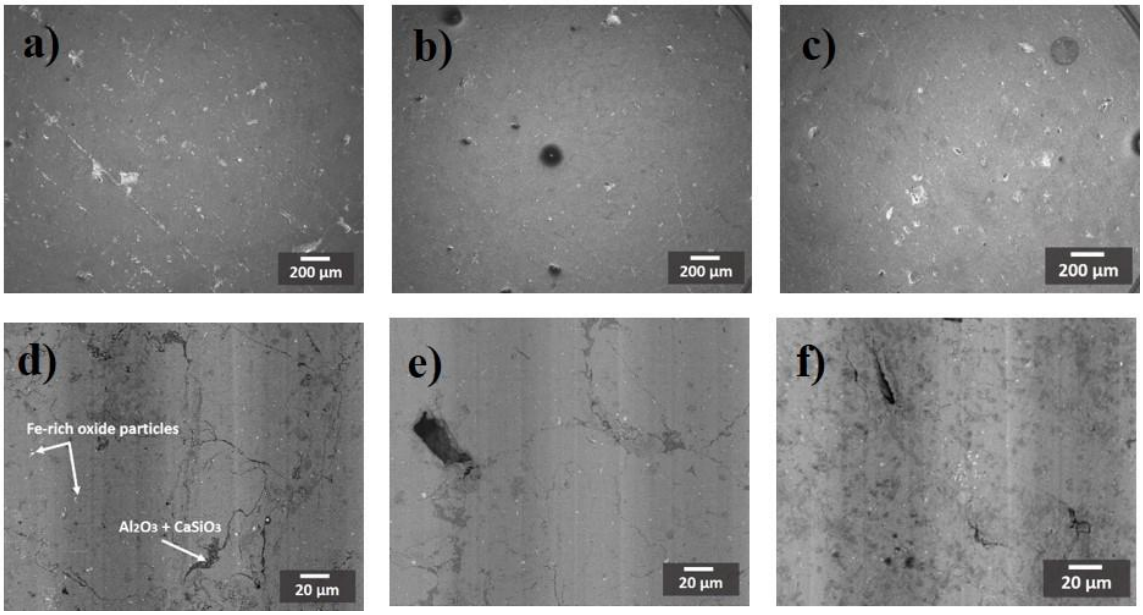

Figure 2. SEC images Aluminium Matrix Composites 6061/CaSiO3, a) 0.5 %, b)1.0% and c) 1.5 % CaSiO3 respectively. BSE images of the Aluminium Matrix Composites 6061/CaSiO3, d) 0.5 %, e)1.0% and f) 1.5 % CaSiO3 respectively.

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