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Aluminium Matrix Composite ($AA6061/CaSiO_3$) Powders Obtained by Ball Milling

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Materials with a high strength/weight ratio are attractive for aerospace and transportation applications. Specifically, Aluminium Metal Matrix Composites (AMMCs) are materials used to fabricate components for the aerospace and transportation industries [1-2]. These composites show a high strength/weight ratio, good mechanical properties, and greater durability due to the addition of particles as reinforcements [1-3]. Powder metallurgy is widely used to fabricate AMMCs [3,4]. Alloy mechanical milling (high energy ball milling) is a conventional route to metallic powder preparation. Besides, particle reinforcements can be used to cut very ductile alloys and prevent lamination. The present work focused on studying the effect of $CaSiO_3$ (wollastonite), used as reinforcement particles of AA 6061 alloy, to produce powders of $AA6061/CaSiO_3$ obtained by ball milling.

The experimental procedure was as follow. Firstly, AA 6061 powders were prepared by the mechanical grinding of alloy bulk to a particle size > 500 µm. Then, a mixture of AA 6061 powders and 10 % vol. of $CaSiO_3$ powder was mechanically milled using the Fritsch Pulverisette ball mill at 350 rpm for 1 hour. Zinc stearate was used as a lubricant to improve milling. The AA6061/CaSiO3 powders were characterized by scanning electron microscopy and energy-dispersive X-ray spectroscopy (SEM / EDS).

Figure 1a shows the typical morphology of the raw AA6061 powders. It comprises highly deformed, twisted, and elongated particles. Figures 1b-c show the $AA6061/CaSiO_3$ powders obtained through mechanical milling. The powders have a particle size of around 100 µm with irregular morphology. A BSE image (Figure 2) showed that small $CaSiO_3$ particles are uniformly distributed onto the surface of AA 6061 alloy particles. The EDS revealed that there is also scarce Fe oxide particles due to the mechanical mill. The present results suggested that $AA6061/CaSiO_3$ composite powders were successfully prepared by ball milling.

References

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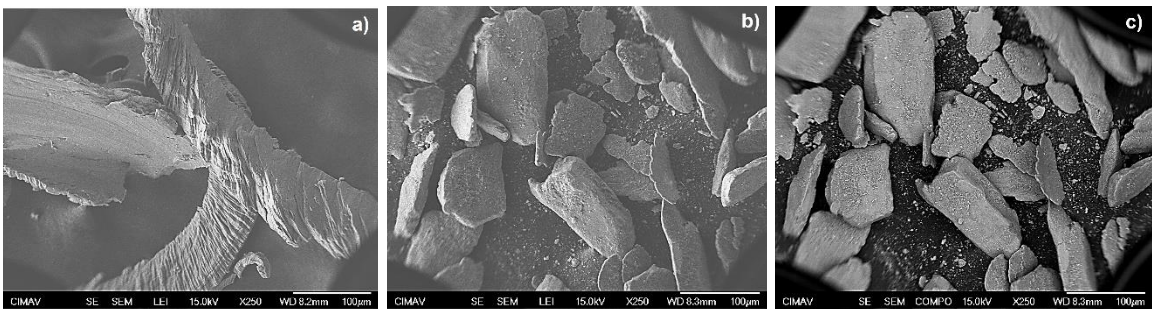

Figure 1. SEM images at X250, a) SEI of AA 6061 alloy after mechanical grinding, and AA6061/$CaSiO_3$ powder composite after ball milling b) SE image and c) BSE image.

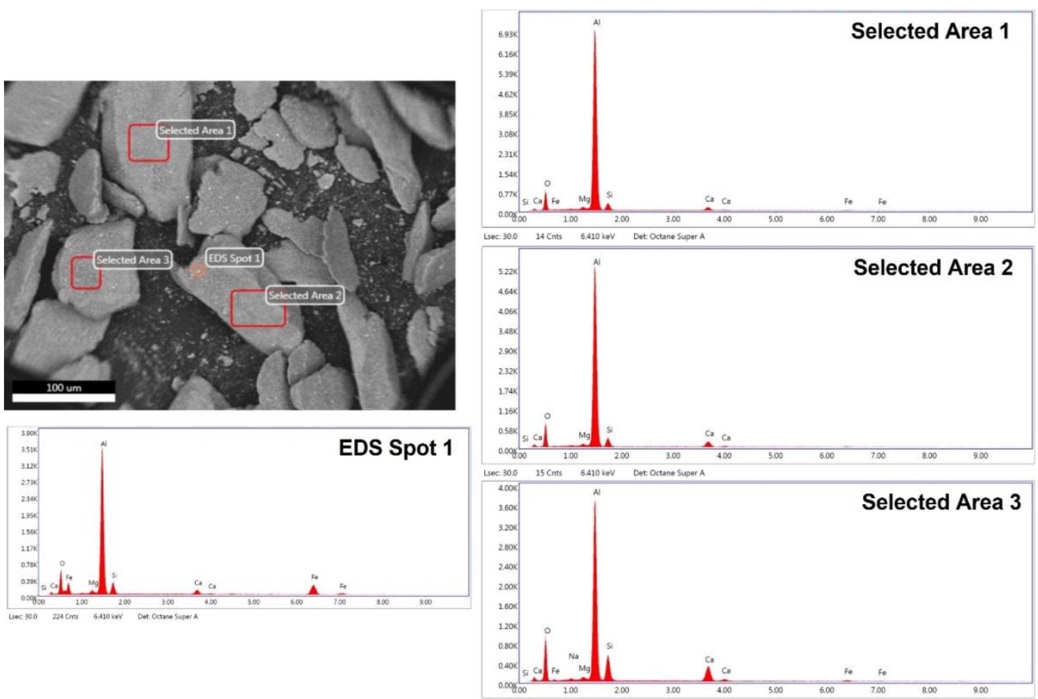

Figure 2. BSE image of the AA6061/$CaSiO_3$ composite after ball milling and EDS analyses taken in the red enclosed areas of the specimen.