Aqueous colloidal processing and liquid-phase assisted spark plasma sintering of nanostructured SiC reinforced with carbon nanotubes

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Liquid-phase-sintered (LPS) SiC is a very hard ceramic with great potential for its use in tribological applications. Several processing strategies have been developed to improve the wear resistance of the LPS SiC ceramics, namely, reduction in the content of sintering additives, hardening of the intergranular phase through in-situ nitriding, reduction in the cation size of rare-earth oxides used as sintering additives, refinement of the grain size, and grain lengthening. Also, carbon nanotubes (CNTs) are being introduced in a variety of polycrystalline ceramic matrices to improve the wear performance, as they act as reinforcements while reducing the friction coefficient. A critical step in this area is the preparation of homogeneous dispersions of CNTs among the ceramic particles without CNTs agglomeration, especially if the ceramic particles have nanometre sizes.

With these premises in mind, here we have studied the aqueous colloidal processing of powder mixtures of SiC and $Y_3Al_5O_{12}$ nano-powders with carbon nanotubes. The study involves both the rheological characterization of aqueous suspensions and the microstructural characterization of the resulting powder mixtures obtained by the freeze-drying of the suspensions. Then was densied by spark plasma sintering under different conditions of temperature, pressure and holding time.

References

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Figures

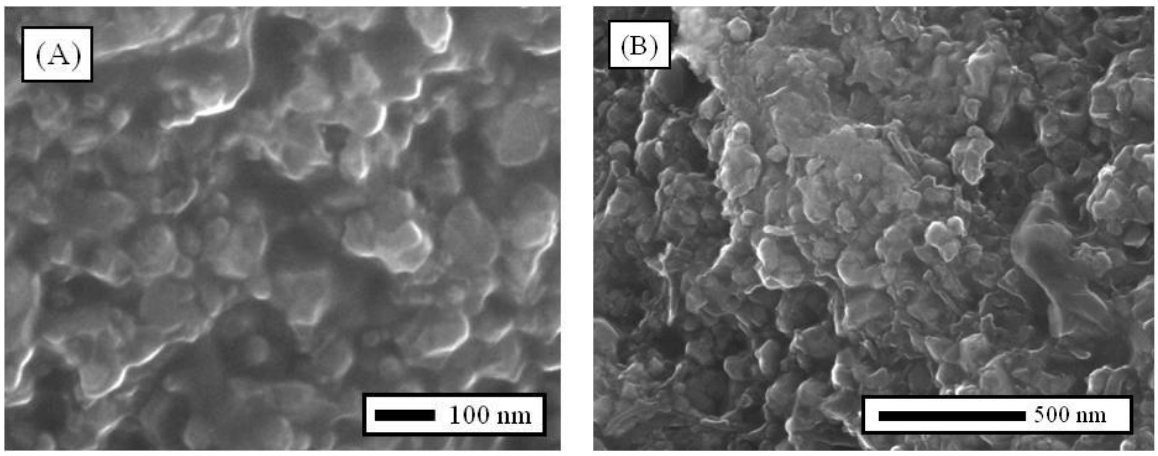

Figure 1.- Sintered materials (A) SiC without CNTs and (B) SiC with CNTs by spark plasma sintering