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EELS Characterization of Nanofibers in Al-C-Al_2O_3 Composites Produced by MA.

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Aluminum-based metal matrix composites (MMC) reinforced with ceramic particles are demanded because of their low density and high specific stiffness. In addition, the ceramic particles increase significantly the wear resistance, the high temperature strength and the refractoriness. Different processing techniques can be used for the production of MMC, which can be grouped into two main routes depending on the state of the matrix during the fabrication process. These are the liquid and the solid routes.

Dispersion strengthened materials belong to the group of composite materials, which are made mainly by the techniques of Powder Metallurgy (PM). Their microstructure is composed by a polycrystalline matrix, in which dispersed particles are incorporated (mainly oxide, carbide and nitride).

Aluminum–base composites reinforced with ceramic particles are promising engineering materials with adequate strength to meet industrial requirements.

In this work, we produced a novel aluminum-base composite (Al-C-Al_2O_3) by MA aluminum and graphite powders under several conditions. Graphite is a dispersive element and the alumina comes from the oxide surface of aluminum powders. The brittle alumina shell is broken during the MA process and at the end of the process it is dispersed in the Al-C particles.

Figure 1 shows a representative view of the microstructure observed in the Al-C-Al_2O_3 composites produced by mechanical alloying.

The microstructural characterization in the as milled products reveals that the Nanofibers present in composites have a composition similar to alumina, as shown by electron energy loss spectroscopy (EELS). It is apparent that oxygen is only found in the Nanofibers zones and it has combined with Al forming Al_2O_3. Microanalysis shows the presence of carbon in the Nanofibers region.

Figure 2 shows an EELS spectrum, obtained from Nanofibers. It is observed a high similitude with alumina-α spectrum taken from EELS Atlas. At present, characterization simulation is being carried out in order to confirm these previous observations. However, we can say in advance that carbon has an important effect in Al_2O_3-α crystallization.

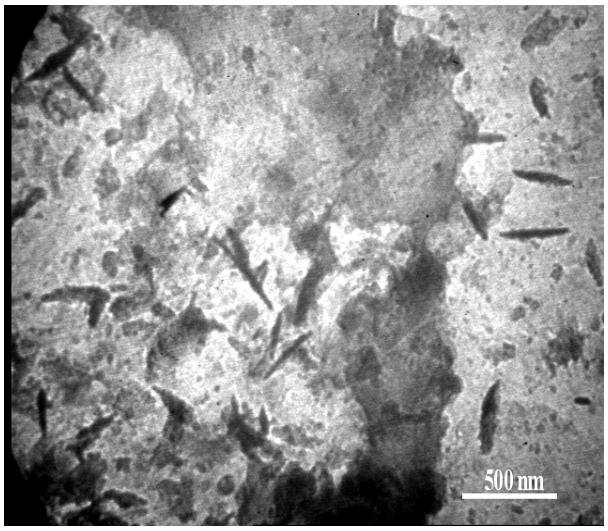

Figure 1.- TEM micrograph from Al-CAl_2O_3 micro composite showing the typical microstructure.

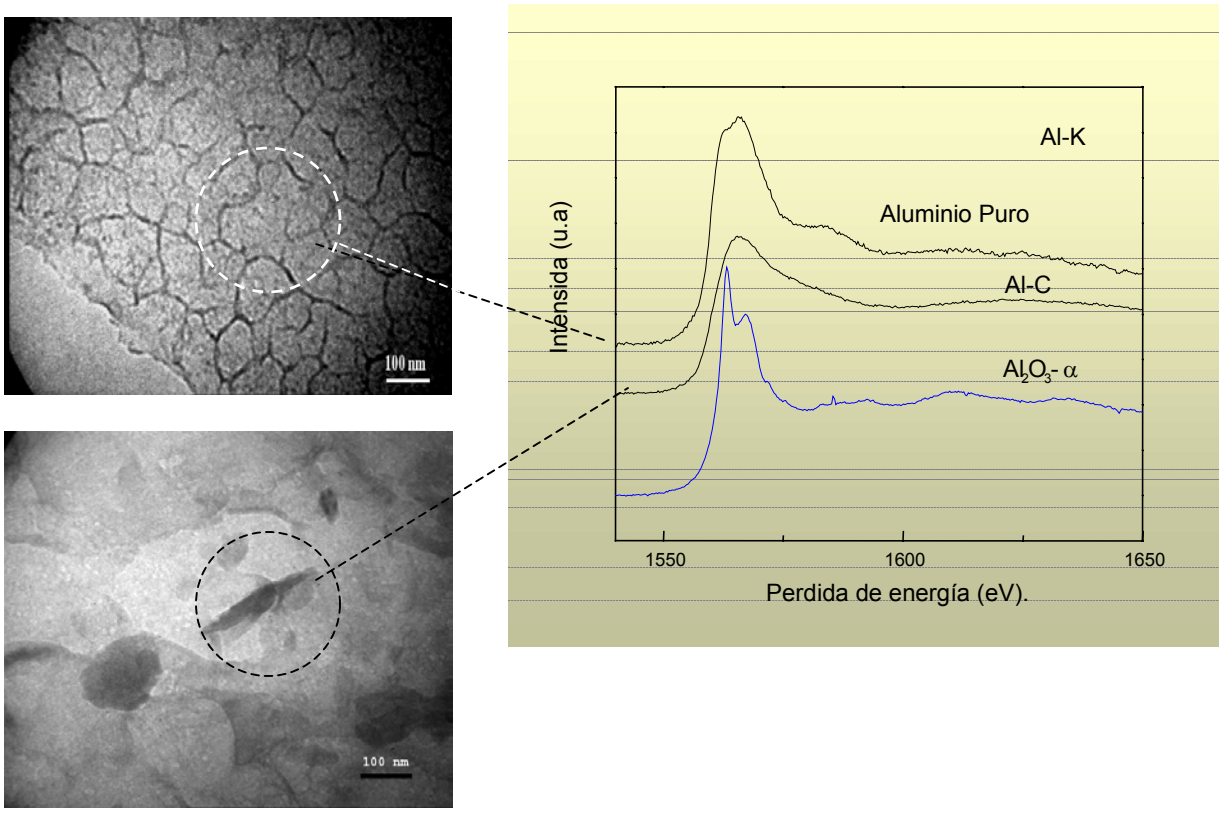

Figure 2.- TEM micrographs and EELS spectra from aluminum matrix and alumina Nanofibers dispersed into the aluminum matrix.

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