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MET Analysis of the ZrO_2-Y_2O_3/Al_2O_3-(Pseudobohemite derived) Composite Powders.

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The chrystallografic structures of both oxides zirconia and alumina, can be different upon their composition and the processing route. In this work, zirconia-ytria / pseudobohemite (seeded whith alpha-alumina) composites, with different compositions were formulated. The initial powders were put on suspension and those suspensions were spray dried at optimized conditions[1]. After that, they were calcined at 1200ºC for 1 hour, to transform the original pseudoboehmite into alpha-Al_2O_3 and remanent monoclinic-zirconia the into tetragonal-zirconia.

The results shown in figures 1 and 2, correspond to the 100% alumina and 85% alumina samples, respectively. Those samples are representative of the chrystallografic phases found in the other composites. In these, the pseudobohemite presented a serie of transformations during the thermal treatment[2]. The figures 1a and 1b correspond to the pure alumina sample, they show a diffraction pattern and a high resolution TEM image, respectively. The figures 2a, 2b and 2c show a tetragonal zirconia diffraction pattern, a monoclinic zirconia diffraction pattern and a high resolution TEM image from a monocrinic grain, respectively.

According with the obtained results there were found the tetragonal and monoclinic phases of zirconia. The original powders of zirconia-ytria had 35% of monoclinic phase, according with the equilibrium phase diagram[3] and with the thermal treatment the zirconia must present only tetragonal phase, but apparently there wasn't enough time to reach the equilibrium and get the total transformation.

The alumina presented only the alpha-alumina phase in all samples. There appear some forbiden reflections (marked with x) on the diffraction alpha-alumina pattern (fig.1a). These kind of reflections had been detected only on alumina thin films formed by oxidation of metallic aluminium and calcination at 1200°C[4]. In our case, these phenomenon can be due to the proximity of the θ-α transformation temperature (≈1100°C) to the calcination temperature, that provoques that alpha alumina just formed can't reach the equilibrium.

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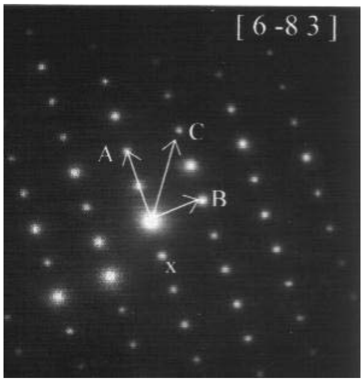
a)



A. (2 0 -2)
B. (0 1 4)
C. (2 1 2)

b)

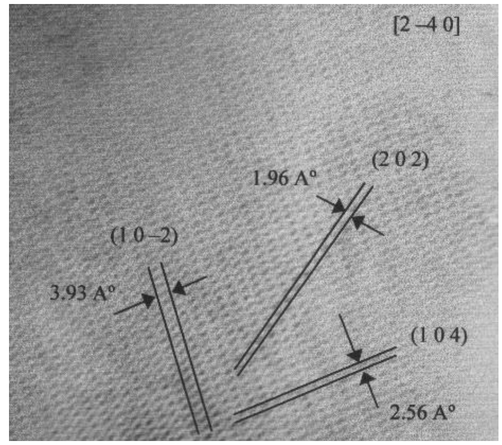
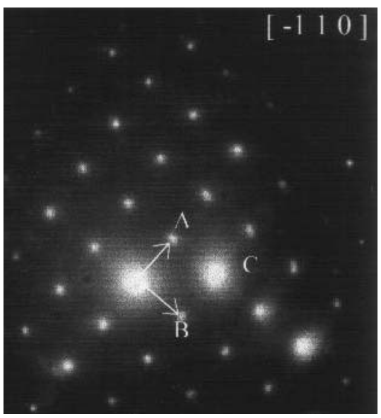


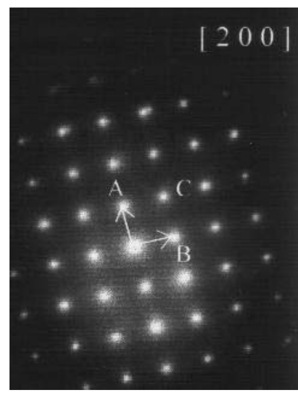
Figure 1. MET of the 100 wt%Alumina powders. b) diffraction pattern of alpha-Al_2O_3, b) HRTEM image. x = forbiden reflections.

a)



A. (0 0 2)
B. (1 1 0)
C. (1 1 2)

b)



A. (0 1-1)
B. (0 1 1)
C. (0 2 0)

c)

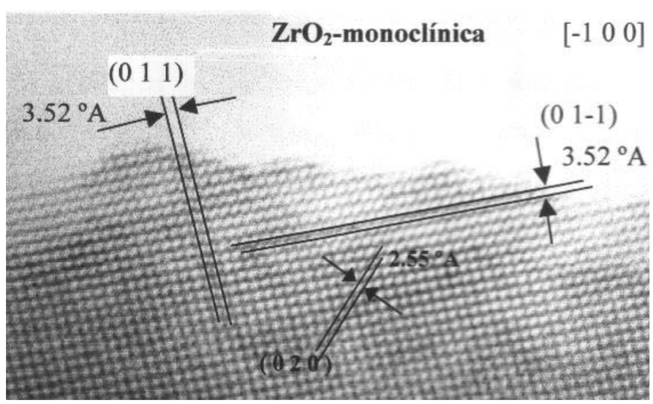


Figure 2. MET of the 85wt%Alumina composite powders. a) diffraction pattern of tetragonal-zirconia, b) diffraction pattern of monoclinic-zirconia and c) HRTEM image of monoclinic-zirconia grain.

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