AEM CHARACTERIZATION OF NANO-STRUCTURES: SOME EXPAMPLES

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CHARACTERIZATION OF NANO QUASICRYSTALLINE AL-ALLOYS

Three Al base alloys: $Al_xFe_yCr_zETM_2$ (%at.), (with ETM: Hf, Mo o W), obtained by the rapid solidification technique called "*Melt Spinning*", were characterized by Analytical Electron Microscopy techniques. Observations were carried out in a Phillips CM200 Transmission Electron Microscope with an Energy Dispersive X- Ray Spectrometer EDAX DX- 4. Samples were prepared by double jet etching in a solution of 25% $H(NO_3)$ + 75% $CH_3(OH)$ (50V, 10 mA).
As is shown in the Figure 1 (a), (b), (c), the microstructure consist essentially in quasicrystals distributed in an α-Al matrix, with a characteristic distribution and size for each alloy. The presence of icosahedral quasicrystals was also confirm for the three cases. Electron Diffraction Patterns were obtained according to the 2, 3 and 5 fold axis. Complementary, EDS measurements determinate an approximated concentration of the matrix and the elements present in the quasicrystals.
The microstructure of WQC Alloy consists of an extremely dense Quasicrystalline Phase precipitation, which is no homogenous nor uniform, within an α-Al Matrix .The microstructure of HfQC Alloy consists of α-Al dendrites surrounded by a combination of phases that may contains QC, plus QC inside the dendrites, near to the boundaries. Two different microstructures were identified in the MoQC Alloy. There are zones where the QC precipitates at grain boundaries and inside the α-Al grains, and there are other regions which presents an homogeneous precipitation of small particles and bigger QC.

CHARACTERIZATION OF CARBON NANOTUBE

Carbon nanotubes synthesized by CVD of analytical grade iron (II) phthalocyanine , under Ar/H_2 atmosphere in a flow reactor consisting of a quartz glass tube heated by a dual furnace fitted with independent temperature controllers. Growing conditions involved temperatures of around 880°C, a total gas flow rate of 30mL/min an Ar/H_2 ratio of 1:1.
The structure of the carbon nanotubes was studied using Scanning Electron Microscopy (SEM – Philips PS 500) and in a Phillips CM200 Transmission Electron Microscope with an Energy Dispersive X- Ray Spectrometer EDAX DX- 4. Figure 2(a) shows a typical SEM image of carbon nanotubes grown on quartz substrates. As can be seen, carbon nanotubes grow well aligned vertically to the substrate. The tubular structure was observed by TEM (Figure 2(b)). They are multi-walled (MWCNTs) and have a bamboo- like structure with iron nanoparticles encapsulated at the tips (dark points in fig. 1b). The synthesized MWCNTs are $(18 \pm 2)\mu m$ in length, and have average inner and outer diameters of (21 ± 3) nm and (48 ± 5) nm, respectively. The diameter of the iron particles is of (21 ± 3) nm.

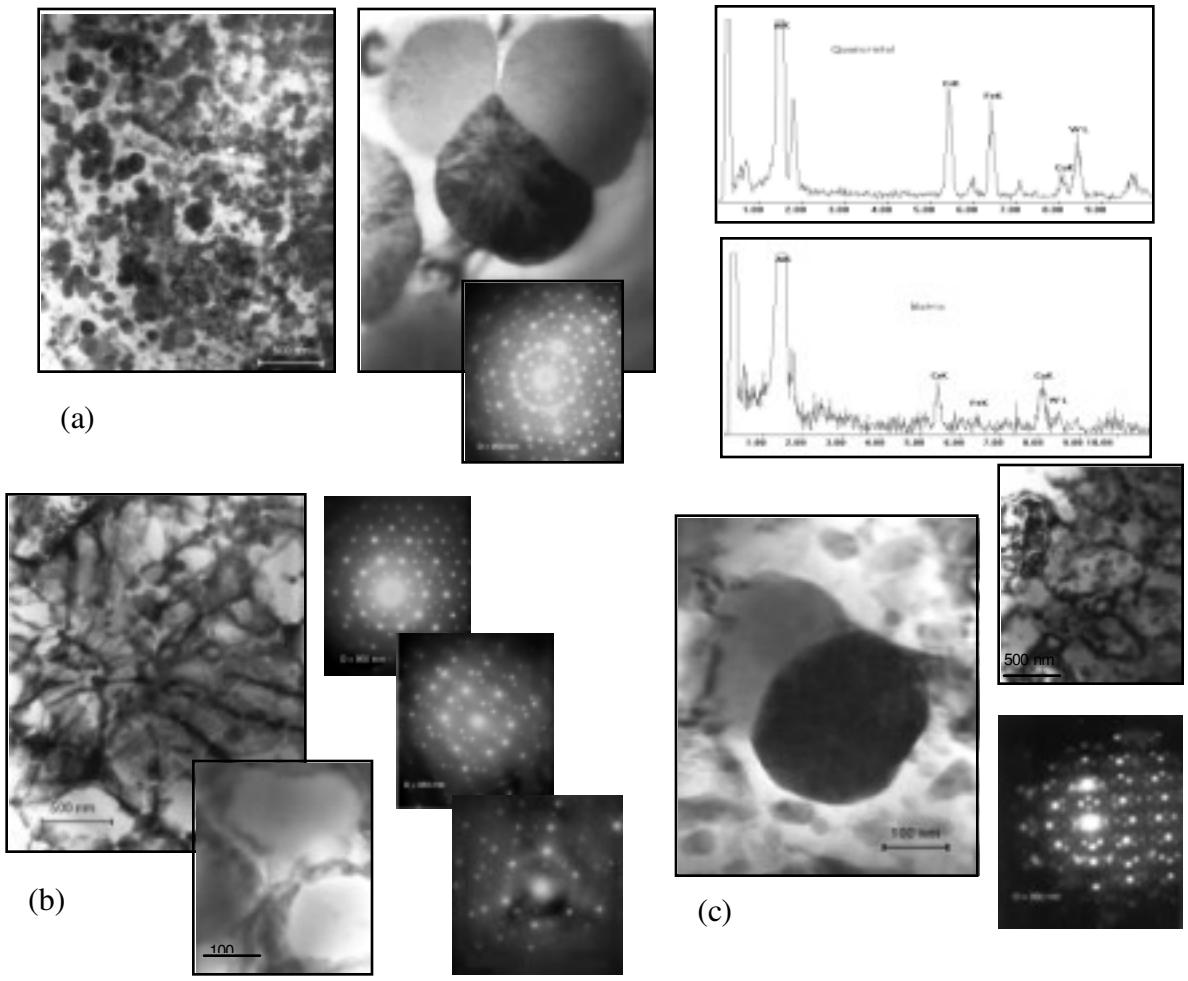

Figure 1: BF micrograph, SAD and EDS spectrum for (a) W_{qc}, (b) Hf_{qc}, (c) Mo_{qc} alloy.

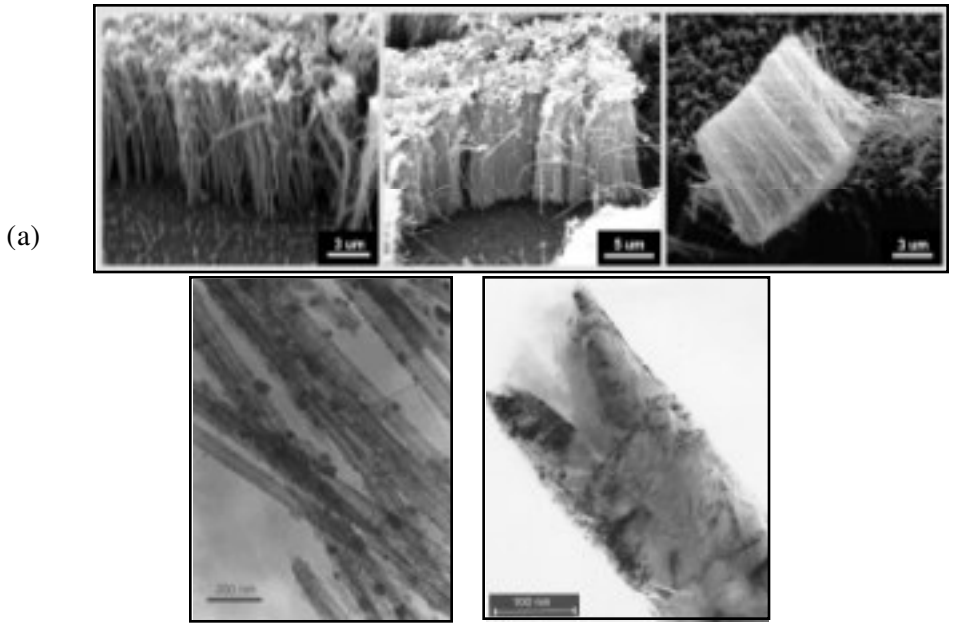

Figure 2: (a) SEM image of carbon nanotubes grown on quartz substrates (b) TEM micrograph.