11th International Conference
on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

Important Parameters on Development of Nanostructured Films of Alpha-Hematite

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Abstract: Thin films of hematite (α-Fe_2O_3) have been synthesized by two methods: sol-gel and hydrothermal. The films produced by sol-gel method had a worm-like nanostructure (Figure 1.a) and were deposited by spin-coating technique, resin viscosity and number of layers are characteristics that influence the film nanostructure. The hydrothermal synthesis produced single crystals nanorods with the (001) plane oriented vertically with the substrate (Figure 1.b). In this work we had observed the influence of heat treatment of the substrate on the development of the nanostructure.

Development of nanostructured materials has been the focus of many researcher groups due to the new and unique characteristics and properties achieved by these materials. In this work we studied the influence of synthesis method on the nanostructure of hematite (α-Fe_2O_3) thin films. The abundance, stability, environmental compatibility and band gap energy are some of the characteristics that lead us to choose the hematite for our research. One of the applications of this material is as photoanode for photooxidation of water, which efficiency are hardly bounded with the kind of nanostructure.

Thin films of hematite were produced by two methods; the first one was the sol-gel synthesis, the films were deposited on a conducting glass (FTO cover layer) by spin-coating technique and they were produced with one and four layers, after each layer deposition the films were or heat treated. The sol-gel synthesized films had a worm-like structure and the number of layers and substrate surface are characteristics that have influence on the film properties. The second method used was the hydrothermal synthesis. In this case the thin films were produced in an aqueous solution of $FeCl_3$ and $NaNO_3$ around 100ºC. In this method the films were formed by the growing of nanorods single-crystals well oriented. The (001) plane is oriented vertically with the substrate. In both methods were observed that a previous heat treatment on the substrates produced a better interaction with the films, in the case of sol-gel films the heat treatment avoid the detachment and also has a small influence on the grains size. The hydrothermal synthesized film had shown a better orientation and also a more homogenous nanostructure on the heat treated substrate.

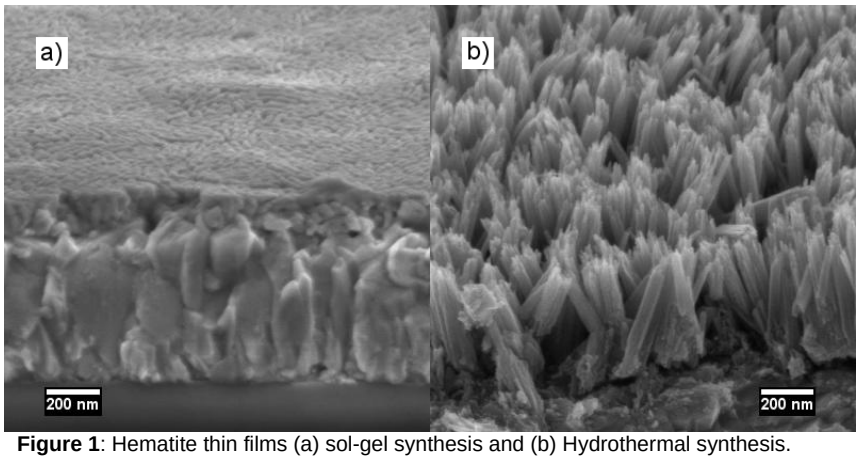

Figure 1: Hematite thin films (a) sol-gel synthesis and (b) Hydrothermal synthesis.

F. L. Souza, K. P. Lopes, E. Longo, E R. Leite, Phys. Chem. Chem. Phys., **11** (2009) 1215-1219.
F. L. Souza, K. P. Lopes, P. A. P. Nascente and E. R. Leite,. Solar Energy Mat. and Solar Cells, 93, (2009) 362-368