

Electrochemical Comparative Study of Anatase, Rutile and Brookite Nanoparticles Synthesized in Aqueous Medium

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Titanium oxide TiO₂ has found extensive use in a great variety of applications among which electrode materials for dye-sensitized solar cells. The polymorphs of TiO₂, rutile, anatase and brookite exhibit specific physical properties, band gap, surface states... For many applications the size of particles is an important parameter because it determines the surface to volume ratio which greatly influences many properties [1]. TiO₂ anatase is the most used phase for photovoltaic applications [2] and brookite seems potentially interesting, its electrochemistry could therefore be investigated [3,4].

Nanometric particles of anatase, brookite and rutile polymorphs, were synthesized by thermolysis of TiCl₄ in aqueous medium. The control of the conditions of precipitation (acidity, nature of anions, ionic strength, titanium concentration...) allow the control of crystalline structure, size and morphology of particles. Pure brookite has so been recently synthesized for the first time by "Chimie douce" in aqueous solution, fig1 [3]. Spheroidal anatase with nanometric size were synthesized in the range 4 to 10 nm [5]. At last, rutile with various shape (needle, rod or spherical) were obtained.

This presentation is focused on the comparison of the electrochemical (fig2) and spectroelectrochemical (fig3) behavior of anatase, rutile and brookite nanoparticles. *A priori*, brookite could be a good candidate for photovoltaic devices.

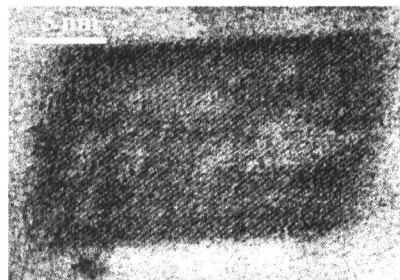


Figure 1: TEM micrograph of brookite nanoparticles

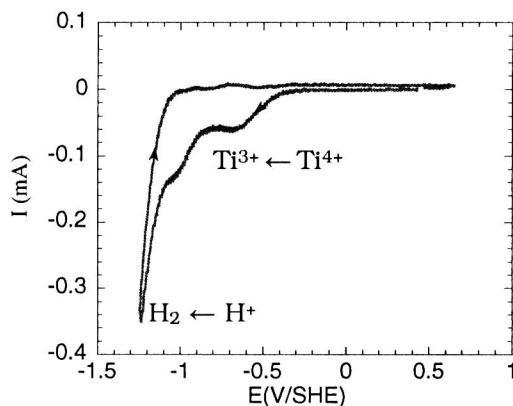


Figure 2: Cyclic voltammogram of brookite nanoparticles thin film/ECS

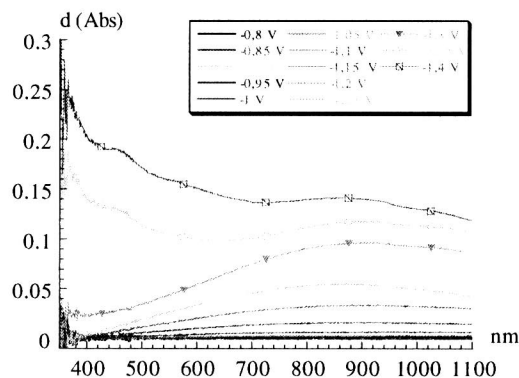


Figure 3: Visible spectra of brookite at different fixed potentials/ECS

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[5] A. Pottier, S. Cassaignon, C. Chanéac, E. Tronc, J. P. Jolivet, *submitted*