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Microwave hydrothermal synthesis of α-Fe_2O_3

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Abstract – Iron oxide was synthesized by the microwave hydrothermal method. The samples were characterized by IR spectroscopy, X-ray diffraction (XRD) and the morphology was evaluated by scanning electron microscopy (SEM). The resultant powder was characterized as α-hematite, the most stable phase of iron oxide. IR spectra show the formation of FeO_6 polyhedra, with a small dislocation in the position of the bands. The authors acknowledge the financial support of FINEP/MCT

Hematite has important technological applications, being used as in catalyst, magnetic material, pigments, gas sensor, biomaterial and others [1]. Synthesis of Fe_2O_3 in nanometric scale can improve some properties, especially related to surface phenomena. Among the synthesis methods available to obtain nanoparticles, the microwave hydrothermal method [2] was chosen in the present work, due to its high kinetic, which accelerates the synthesis process, besides being environmental friendly, as water can be used as solvent.

In this work, α-Fe_2O_3 synthesis was done in aqueous solution using $Fe(NO_3)_3.9H_2O$ as precursor, NaOH as alkalinizing agent and polyethylene glycol (PEG 300) as template. The suspension was placed in a teflon reactor and coupled into the microwave oven. Synthesis was done at 150°C for 30 or 60 min. Characterization was done by infrared spectroscopy (IR), X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM).

IR spectra showed well defined Me – O bands, indicating that both samples had a high short range order, with the formation of the FeO_6 polyhedra. These vibrations were observed at about 555 and 470 cm^{-1}, assigned to Fe-O bond, with some dislocation in relation to literature data [3]. The XRD patterns (Fig. 1) confirmed the crystallization of the material, with the formation α–hematite, for both synthesis times. The morphological evaluation was carried out by SEM (Fig. 2). It was observed that spherical particles were formed and with a high agglomeration degree among them.

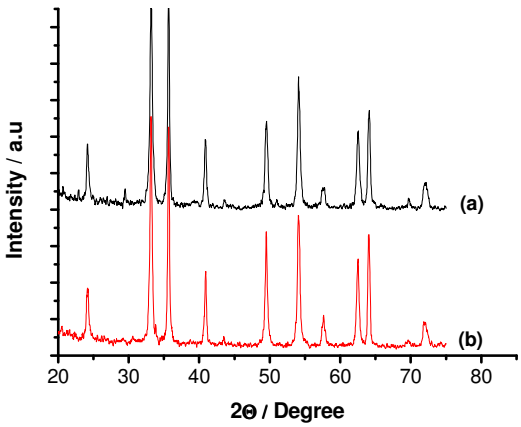

Figure 1: XRD patterns of α-Fe_2O_3 after synthesis during: (a) 30 min; (b) 60 min.

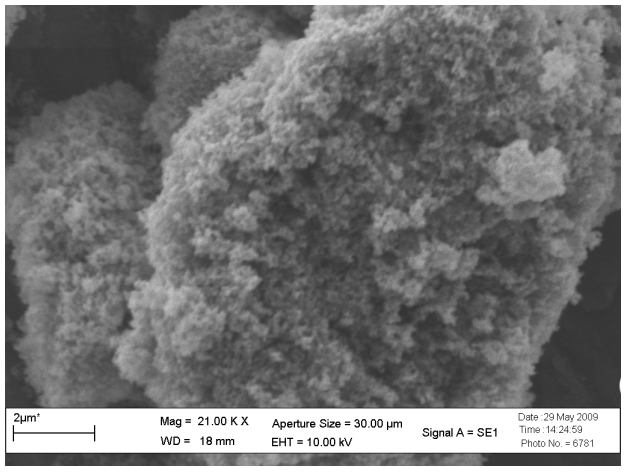

Figure 2: SEM micrograph of α-Fe_2O_3 with synthesis time of 60 min.

References

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