

# Characterisations of FeSe<sub>2</sub> thin films synthesised by a simple selenization of amorphous iron oxide films pre-deposited by spray pyrolysis

B.Ouertani<sup>a</sup>, J.Ouerfelli<sup>b</sup>, M.Saadoun<sup>a</sup>, B.Bessaïs<sup>a,\*</sup>, H.Ezzaouia<sup>a</sup>, J.C.Bernède<sup>c</sup>

<sup>a</sup> Institut National de Recherche Scientifique et Technique, Laboratoire des Applications Solaires, Groupe de Photovoltaïque et des Matériaux Semi-conducteurs, BP 95, 2050 Hammam-Lif, Tunisie. Tel : 216-71-430 160, Fax: 216-1-430 934

<sup>b</sup> Faculté des Sciences de Tunis, Laboratoire de Physique de la Matière Condensée (LPMC), El Manar II -Tunis, Tunisie. Tel : 216-71-872 600

<sup>c</sup> Equipe de Physique des Solides pour l'Electronique, Groupe Couches Minces et Matériaux Nouveaux, Université de Nantes, FSTN, 2 rue de la Houssinière, BP 9209 44322 Nantes Cedex 3, France.

In recent years, much attention has been paid to selenium-based alloys because of their physical and chemical characteristics, especially the Fe-Se system. The present paper investigates a simple and non toxic method to transform amorphous pre-deposited iron oxide films into FeSe<sub>2</sub> thin films. The iron oxide films were prepared from spray pyrolysis of FeCl<sub>3</sub>.6H<sub>2</sub>O (0.03M)-based aqueous solution onto glass substrates heated at 350°C. The amorphous iron oxide films were heat treated under a selenium atmosphere (10<sup>-4</sup> Pa) at different temperatures for six hours. X-Ray Diffraction (XRD) was used to investigate the structure of the obtained films. A single FeSe<sub>2</sub> phase having good crystallinity was obtained at an optimum selenization temperature of 550°C. Optical analyses of the FeSe<sub>2</sub> films obtained at 550°C enabled us to deduce a large absorption coefficient ( $\alpha \sim 10^5 \text{cm}^{-1}$ ,  $\lambda < 800$  nm) and an indirect band gap slightly higher than 1eV. Surface SEM observations show inhomogeneous films. The electrical properties of the as prepared films were treated for high and low temperatures (20-550K).

**Keywords:** Thin films, Spray pyrolysis, Selenization, iron oxide, FeSe<sub>2</sub>.