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On the properties of perovskites thin films for solar cells

Mihaela Girtan

Photonics Laboratory, (LPhiA) E.A. 4464, SFR Matrix, Université d'Angers, Faculté des Sciences, 2 Bd Lavoisier, 49000 Angers, France

*mihaela.girtan@univ-angers.fr

Structural and morphological properties of $CH_3NH_3PbI_3$ thin films deposited by spin coating, with different spin speeds on glass and ITO patterned substrates were investigated. It results that long length acicular crystals, growth parallel to substrates (> 200µm for spin speeds of 800RPM/min). For low deposition spin speed these crystals are interconnected and deposited films present high electrical conductivity. The XRD investigations indicate the formation generally of the cubic phase, or a mixture between cubic and tetragonal phase. For compact films the absorption is high over a large range of spectral domain (from 200 nm to 2100 nm), the transmission being lower than 20% in IR and less than 15 % in the visible domain. From electrical properties point of view, films are highly sensitive to light. A decrease of the electrical resistivity with three order of magnitude is noticed when films are exposed to a white light of a solar simulator with an intensity of 1000W/m^2, but also an important decrease is observed also when films are exposed to a continuous low intensity ambient light, at least one order of magnitude in less than six seconds. This behavior is identical no matter the films thickness. The variation of the electrical resistivity at exposure to light in function of time and light intensity and the variation of the electrical resistivity in function of temperature were investigated and interpreted. The experimental results, since now, comforting the assumption of a multiband model.

Keywords: $CH_3NH_3PbI_3$, perovskites, electrical conductivity, photoconductivity, band gap