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Room temperature photochemical stabilization of catalyst thin films of the metastable beta-Bi2O3 phase

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This work shows how the metastable high-temperature β-Bi_2O_3 phase is prepared at low temperature and stabilized at room temperature in thin films, by using UV-light as an alternative energy source to the traditional thermal processing methods. The films of this oxide were prepared at only 250°C, far below the temperature at which the phase is thermodynamically stable, from strong UV-absorbing solutions containing a bismuth(III)-*N*-methyldiethanolamine complex.[1-2] The β-phase is not only stabilized at room temperature, but also shows a wide temperature range of chemical stability, between room temperature and 450°C. The use of advanced characterization techniques, X-ray synchrotron radiation and four-circle diffractometry and Combined Analysis, allows us to unequivocally identify the development in the films of the pure β-Bi_2O_3 tetragonal polymorph. Electrical measurements carried out close to room temperature in the β-Bi_2O_3 films indicate a behavior compatible to that measured in bulk β-Bi_2O_3 materials at the high temperatures where the phase is thermodynamically stable. The potential of these materials for visible light activated photocatalysis is demonstrated by the remarkable visible light absorption of these β-Bi_2O_3 films, which is associated to an excellent photodegradation of dyes.

1. D.Perez-Mezcua, R.Sirera, R.Jimenez, I.Bretos, C.De Dobbelaere, A.Hardy, M.K. Van Bael and M.L.Calzada. *J.Mater.Chem.C*, **2014**, *2*, 8750.

2. I.Bretos, R.Jiménez, A.Wu, A.Kingon, P.M.Vilarinho and M.L.Calzada. *Adv.Mater.*, **2014**, *26*, 1405.

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