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Study on the porosity of Mn and Ga doped Zno films synthesized by sol-gel method

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Resume: Photocatalytic, sensing and light conversion performance of ZnO thin films are strongly affected by materials porous structure. The pores formation, distribution and size are proved to be tailored through films deposition in the presence of doping impurities as well as during post annealing treatments. In this work, thin films of ZnO doped with 5 at. % Mn and Ga have been prepared by sol-gel method starting from acetate and nitrate precursors, and spin coated on Si/SiO2 and glass substrates. The films were sequentially annealed at 500 oC in air for 1 h and at 500 oC in nitrogen or air for 2 h. The films structure, morphology, optical absorption/transmission and the refractive index have been assessed. All the films are polycrystalline, wurtzite type, and show preferential orientation along (002) direction. The crystallites size in the undoped films treated at 500 oC in air is about 22 nm, and decreases to 6 nm in Mn doped films and to 8 nm in Ga doped films. The treatment in nitrogen leads to crystallite size of 17 nm in undoped films, 5 nm and 8 nm in the films doped with Mn and Ga. The effect of thermal treatments on the films porosity have been analysed by spectroscopic ellipsometry. The porosity of the films treated in air is about 11% in the undoped films, 10% in the films doped with Mn and 22% in the films doped with Ga. After the second step of annealing performed in nitrogen, the porosity is 6% in undoped films and increases to 18% and 29% for Mn and Ga films.