Ion-Implantation of 111In in tin dioxide doped with Co analyzed with PAC spectroscopy

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In this work, a nuclear technique is used to measure hyperfine interactions in nano-structured samples of powder of semiconducting oxide SnO2 doped with Co. The goal of this work is to compare two techniques of addition of 111In nuclei in samples of SnO2 doped with Co by means of perturbed gamma-gamma angular correlation (PAC). The perturbed gamma-gamma angular correlation (PAC) spectroscopy is used for the measurements of the magnetic hyperfine field (MHF) and the electric field gradient (EFG) at 111Cd radioactive probe sites. The measurement of EFG is used to study the defects introduced into the semiconductor material and also for the identification of different phases formed within the compound. In this work, the techniques are ion-implantation and addition of 111InCl3 solution to the metal nitrate solution before the gel formation. Ion-implantation of 111In in Sn(1-x)Co(x)O2 was made using energy of 160 keV. The 111In was added to the sample by ion implantation in Bonn Laboratory, with energy of 160keV. A rapid thermal annealing (RTA) was carried out after the implantation, with a temperature of 723K for 10 minutes. The pellets were doped with 1 and 2 percent of Co and prepared by the sol-gel method [1]. Sol-gel method: a solution is solidified through a complexation process to produce a gel. First, Sn is dissolved using dilluted nitric acid. The transition metal element or rare earth is dissolved separately and after the dissolution is added to the Sn solution. In the next step, added citric acid and ethylene glycol to form an organic solution which becomes gel after the solution is dried. This gel is dried for 10 hours in 380?C. The resulting powder is pressed to a pellet which is annealed at 600?C for 10h in under nitrogen atmosphere. The advantages of this method are the guarantee of the stoichiometry and the need of lower temperatures for the formation of the compound [1]. The PAC spectra were made with measurements in temperature range of 10-295K. The results shows no significant changes in the values of hyperfine parameters of the tin site in the crystall lattice. Both techniques reveal the same electric quadrupole interaction for the substitutional site. References [1] J. M. Ramos, A. W. Carbonari, M. S. Costa, R. N, Saxena Hyp. Inter. 197(2010)239