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## Study of hyperfine interactions in CeO<sub>2</sub> nanoparticle by PAC spectroscopy using <sup>111</sup>Cd

Cerium dioxide (CeO<sub>2</sub>) is quite important for the high-technology industry with various applications such as in automotive industry, medicine, oxygen sensors, and protectors of the radiation and so on. This material has been studied recently using a variety of techniques. A case of special interest is that Co-doped Ceria is very attractive for multifunctional spintronic applications. In this work we have used PAC technique to measure the hyperfine interactions in a pure nanostructured CeO<sub>2</sub> as well as the one doped with 3d transition metal Co. The samples of pure and Co-doped CeO<sub>2</sub> were prepared by the Pechini sol-gel method from pure Ce and Co elements. The samples were characterized by X-ray Diffraction (XRD) Scanning Electronic Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDS). The radioactive probe nuclei <sup>111</sup>In-<sup>111</sup>Cd was introduced during the sample preparation in all cases. To better study the contribution to the ferromagnetism of the samples due to the effect of vacancies in the structure or the presence of dopant transition metal ion, several different experiments were carried out with pure and doped CeO<sub>2</sub> which were prepared and annealed at different temperatures between 380oC and 700oC in air and nitrogen. The PAC measurements were performed at different temperature between 15 K and 1130 K. For instance, in Ceria pure with annealing at 500 oC, it was found at 400 K three quadrupole frequency  $\nu Q_1 = 106$  MHz with  $f_1 = 58$  %,  $\nu Q_2 = 144$  MHz with  $f_2 = 22$  % and  $\nu Q_3 = 14$  MHz with  $f_3 = 20$  %. This result is also a strong indication that  $f_1$  should be assigned to <sup>111</sup>Cd in Ce sites while  $f_2$  in oxygen vacancy and  $f_3$  is possible nuclei probe in grain surface.

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