STUDY OF THE HYPERFINE INTERACTION DEPENDENCE ON THE CRYSTALLITE SIZE AND APPLIED TEMPERATURE IN $CoFe_2O_4$ BY γγ-TDPAC

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Spinel ferrites (including $CoFe_2O_4$) are mainly used because of their ferrimagnetic properties (i.e. as memory storage devices). In recent years, they are expected to acquire new broad application for catalysts preparation: a) based on their own catalytic properties or b) by combining them with other catalysts in nanocomposites of the type «core/shell». The ferrimagnetic properties of the ferrites are essential for both types of catalysts, because it allows easy separation of the catalyst from the reaction mixture and their further recycling. The general rule is that with the reduction of crystallite size, the catalytic activity of the ferrites increases but at the same time decreases the magnetic susceptibility. In the case of gas-solid heterogeneous catalytic reactions which generally occur at high temperatures (200 – 800°C), an important characteristic becomes the Neel temperature.

In this paper, a study of the magnetic hyperfine interaction in cobalt ferrite samples of different crystallite size is performed using the γγ-TDPAC method using ^{111}In (^{111}Cd) as probe nucleus.

The γγ-TDPAC method is based on the introduction of a radioactive isotope (the probe-111In) into the sample, the decay of which is accompanied by the emission of cascade γ-quanta. The angular distribution of the emitted cascade γ-quanta provides information on the hyperfine fields with which the sample affects on the embedded nuclei.

The studied samples ($CoFe_2O_4$) were synthesized using epoxide sol-gel method and the radioactive isotope (^{111}In) was added during the synthetic procedure. The crystallite size was varied by preparing the samples using different annealing temperature. The different samples were investigated at room and high temperature and *as prepared* (amorphous) sample was measured *in situ* while gradually raising the temperature from room temperature to 775°C.

We observed unambiguous dependence of the magnetic hyperfine interaction from the crystallite size and disappearance of the magnetic hyperfine interaction above Neel temperature.