Abstract

Author: Iwona Rogalska

Title: Electron magnetic resonance spectroscopy of dopants from the iron group in the Al_2O_3, ZrO_2 powders and PbI_2 nanoparticles

The main objective of research in the presented thesis is electron magnetic resonance (EMR) spectroscopy of dopants from the iron group in the Al_2O_3, ZrO_2 ceramic powders and PbI_2 nanoparticles with magnetic component of manganium (Mn). The last materials are in response to demands coming from spintronics – determination of the energy electronic structure, Curie temperature and study of the magnetic interactions. While the first one – Al_2O_3 and ZrO_2 ceramic powders – are widely used in various industries, including the aerospace industry for precision castings production. Unintentional magnetic impurities observed in this materials are undesirable in the casting process.

The main part of the dissertation applies to analysis of the EMR spectra $Pb_{1-x}Mn_xI_2$ bulk materials and $Pb_{1-x}Mn_xI_2$ nanoparticles embedded in polyvinyl alcohol matrices (PVA) with different compositions. Three types of EMR spectra are observed – low-field wide line, line derived from Zeeman interaction and line with hyperfine structure. The origin of these lines are explained on the base of the Spin Hamiltonian including the *sp - d* interaction.

The second part of the dissertation is dedicated to the EMR spectra analysis of the Al_2O_3 and ZrO_2 ceramic powders (with different size of grains). Collected temperature dependences of the EMR spectra enable us to detect the pollution by magnetic dopants, which are not noticeable using standard methods, e.g. XRD.

The study have shown that EMR method is a universal technique, that allows to obtain valuable information on a variety of the electron paramagnetic systems which is facilitated by high sensitivity measurement as well as by an ability to measure the specific compounds in the presence of many other unidentified compounds. Important is also the relatively short measurement time and straightforward specimen preparation.