MÖSSBAUER SPECTROSCOPY OF Fe-BASED NANOMATERIALS

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There are two opinions concerning the effect of the nanosized grains on magnetic properties and Mössbauer spectra. One of them testifies that nanomaterials have a grain boundary phase (interface region) which decreases the specific saturation magnetization and leads to the additional sextet in the Mössbauer spectrum. The second one treats the changes in spectra by the impurities. In this work the results on α-Fe, $Fe_{90}Ge_{10}$ and $Fe_{77,5}Al_{22.5}$ nanocrystalline alloys are presented.

The nanostructured (8 nm) powders of Fe, bcc disordered $Fe_{90}Ge_{10}$ and $Fe_{77,5}Al_{22.5}$ were produced by mechanical grinding and alloying. The samples were studied by X-ray diffraction, Mössbauer spectroscopy, magnetic measurements and then compared with microstructured ones. With the absence of contamination no changes have been found in the specific saturation magnetization, Curie temperature and hyperfine interaction parameters of the nanomaterials. No additional sextet in the Mössbauer spectra and peculiarities in the temperature dependences of a.c. magnetic susceptibility were found either.

We have registered a slight lines broadening (~ 20%) in Mössbauer spectrum of the nanocrystalline pure Fe. The broadening observed is explained by random in sign and in magnitude anisotropic contribution to the hyperfine magnetic field from the Fe atoms in the interfaces.

The conclusion drawn is that the interface of the nanostructure (boundary and close-to-boundary distorted zones) of 1 nm width considerably have the same magnetic properties and hyperfine interaction parameters in comparison with those in the bulk.

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