MÖSSBAUER STUDY OF THE PROCESS CRYSTALISATION IN NANO-DIMENSIONAL POWDERS FE-C

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The crystallization of nanodimentional powders 30%Fe70%C under pressure of 7.7 GPa at temperatures of 1573 K, 1973 K, 2173 K, 2273 K and 2373 K was carried out. The Mössbauer spectrum of original nanodimensional powder at room temperature showed the presence of hyperfine magnetic splitting lines with the effective magnetic field of pure iron, and also showed the small quantity of Fe_3C iron carbide with $H_{eff} \approx 200$ kOe. Practically the same spectra are obtained for the powders of samples sintered at temperatures up to 1500 K. The Mössbauer absorption spectra of samples after sintering under pressure at temperatures of 1973 K, 2173 K, 2273 K have more complex structure. The analysis of these spectra showed four subspectra of Zeeman hyperfine line splitting with $H_1 \approx 200$ kOe, $H_2 \approx 220$ kOe, $H_3 \approx 180$ kOe and $H_4 \approx 110$ kOe. These spectra contain also a singlet with the isomeric shift of $\delta \approx 1.2$ mm/s. The spectrum with $H_1 \approx 200$ kOe and isomeric shift $\delta \approx 0.3$ mm/s is typical of cementite Fe_3C. The spectra with effective magnetic fields $H_2 \approx 220$ kOe, $H_3 \approx 180$ kOe and $H_4 \approx 110$ kOe can belong to ^{57}Fe in carbide Fe_5C_2, where iron is located in univalent, divalent, and trivalent state respectively. The Mössbauer absorption spectrum of samples after sintering under pressure of 7.7 GPa at temperature of 2373 K demonstrates only one Zeeman six lines of hyperfine magnetic splitting with the effective magnetic field of $H_{eff} \approx 200$ kOe and singlet with the isomeric shift $\delta \approx 1.2$ mm/s. The investigation results of Fe-C system by Mössbauer method correlated with X-ray study and specific magnetisation measurements in the temperature interval of 77–1200 K.