MÖSSBAUER STUDY OF IRON PHASES OF IRON THIN FILMS ON Si/SiO_x SUBSTRATE AND AT DEPOSITED CARBON NANOTUBES

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Phase composition of ~10 nm thick Fe film on silicon substrates with 200 nm thick SiO_x layer after annealing in vacuum and in CH_4+H_2 was investigated using Conversion Electron Mössbauer spectroscopy (CEMS), X-ray photoelectron spectroscopy, and SEM. CEMS spectra show that the original iron film was formed by Fe^{3+} phase. This phase is stable after the annealing in vacuum below 500 °C but formation of phases with Fe^{2+} and Fe^0 was observed after annealing at higher temperatures. Photoelectron spectroscopies detected changes in morphology after vacuum annealing above 300 °C where the continuity of the iron film was broken. Annealing of the Si/SiO_x/Fe samples in CH_4+H_2 atmosphere caused reduction of the original Fe^{3+} to Fe^{2+} and α-Fe. Analysis of CEMS spectra of the sample with grown multi-walled carbon nanotubes shows that the dominating part of iron atoms is present in Fe_3C and Fe_5C_2 phases. Besides their stoichiometric forms spectrum components which can be ascribed to the amorphous $Fe_{5-x}C_{2+x}$ carbides, γ-Fe, and Fe^{3+} were observed.

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