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Mössbauer-Effect Study of Fine Atomic Structure of Fe-Ni-C Alloys

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Abstract: Fine atomic structure of Fe-Ni-C alloys containing of 30-36 wt. % Ni and 0.1-1.0 wt. % C have been analysed by means of a nuclear γ -resonance method. The alloys under investigation were in austenite phase. The study shows that the effective hyperfine magnetic field H_{eff} on the ^{57}Fe nuclei is affected by the presence of C atoms in Fe-Ni alloys and the mean value of H_{eff} fields increase with increasing of C element content in these alloys. It has been detected that increase in carbon content in Fe-Ni alloys leads to a broadening of Mössbauer absorption lines. On the base of analysis of the distribution function of effective hyperfine magnetic field P (H) on the ^{57}Fe nuclei of Fe-Ni-C alloys, magnitudes of the most probable H_{eff} fields have been calculated. The calculated magnitude of these fields for a number of heat treatments regime of Fe-33wt. % Ni-0.7wt. % C alloy are H_{eff} = 320, 290, 260,240 and 220 kOe. The presence of these fields were attributed to the formation of the local configurations in the alloy for which Fe atoms have a different number of Ni and C nearest neighbour atoms in the first coordination sphere. Hyperfine magnetic fields H_{eff} of 290 and 320 kOe corresponded to configurations of Fe atoms for which there is an increasing number of Ni atoms within nearest neighbour distances, and the number of C atoms within such configurations are very low. Other H_{eff} fields could be associated with the configurations for which Fe atoms are surrounded mainly by C atoms. It is further found that the most active processes of atomic redistribution in Fe-Ni-C alloys are taking place within the temperature range 450-600^{o}C.

Key Words: Fe-Ni-C alloys; Fine atomic structure; Mössbauer-effect spectroscopy

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