Low-temperature magnetization behavior in rapidly quenched alloys Fe-Cu-Nb-Si-B

N. Ilin,[1] G. Kraynova,[1] S. Komogortsev,[2] I. Tkachenko,[3] E. Tarasov,[3] V. Tkachev,[1] and V. Plotnikov[1]

[1]*Far Eastern Federal University, 690090 Vladivostok, Russia*
[2]*Kirensky Institute of Physics, Federal Research Center KSC SB RAS, 660036 Krasnoyarsk, Russia*
[3]*Institute of Chemistry, FEB RAS, 690022 Vladivostok, Russia*

The low-temperature magnetization behavior is one of the fundamental characteristics of the ferromagnet. The exchange interaction parameters can be derived from this dependence by using the spin-wave excitation theory. In this work, the low-temperature behavior of magnetization in rapidly quenched Fe-Cu-Nb-Si-B alloys ribbons of 9 different compositions was studied. The dependence *M(T)* was well-fitted by Bloch's law $T^{3/2}$, and the fitting parameters made it possible to calculate the values of the spin-wave stiffness and the mean-square range of the exchange interaction. The linear correlation between the spin-wave stiffness and the Curie temperature was found. Also, the first coordination sphere radii were calculated using the Bethe-Peierls approximation; the obtained values of the radii are close to the nearest neighbor distance of crystalline Fe.

The spontaneous magnetization value at 0K allowed to calculate the average magnetic moment per Fe atom. We have constructed the dependence of the atomic magnetic moment on the average number of electrons per atom for Fe-Cu-Nb-Si-B alloys by analogy with the Slater-Pauling curve for crystalline alloys. The obtained values well-fitted on the line drawn through the points with coordinates (26, $2.9\mu_B$) and (19.2, $0\mu_B$): the first point corresponds to the FCC structure of Fe with a ferromagnetic order, the second point corresponds to the filled argon shell minus two $4s$ electrons.

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