# Physical modeling of nanostructures formation in alloys with high damping capacity on the basis of Fe-Cr

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*The article considers application of physical modeling techniques of the processes of nanostructure production as a result of disintegration of alloys based on bcc solid solutions in the systems of Fe–Cr Fe–Cr–Co into ferromagnetic and paramagnetic phases with the purpose of predicting the best ways of obtaining materials with high damping properties. The requirements for the optimal structure of ferromagnetic alloys with high damping properties and methods of its obtaining are analysed. Two approaches to obtaining high damping properties by means of a multi-stage heat treatment of the alloys are selected as promising. The alloy with a structure of ferromagnetic sponge was selected as a first approach, as a second - one of the 12 basic types of structures appearing in the process of disintegration of alloys based on Fe–Cr, but with a small difference in the compositions of the phases and slight differences in phase magnetizations. Modeling was based on the direct minimization of the free energy of a two-phase alloy, with due regard for the contributions: chemical, magnetic and atomic ordering, the elastic phase deformations, and some others. The used approach is based on the modeling processes and allows replacing real experiments with computing thereby it can accelerate the process of alloy structure and heat treatments optimization and reduce its cost. The optimum types of nanostructures for producing damping properties and schemes for their obtaining are considered. Domains of instability and metastability of solid solutions are calculated as well as prospective ranges of compositions and multistage thermal treatment temperatures for obtaining high damping properties of these alloys.*

***Keywords:*** *thermodinamic modeling, solid solutions, high damping properties alloys, spinodal gap.*

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