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Molecular dynamics modeling of formation processes parameters influence on a superconducting spin valve structure and morphology

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Abstract

The work is devoted to the study of the processes of formation and analysis of the parameters of a functional nanostructure — a superconducting spin valve, which is a multilayer structure consisting of ferromagnetic cobalt nanolayers separated by niobium superconductor nanolayers. The aim of the work was to study the influence of the main parameters of the technological regimes of the formation of these nanosystems: temperature, concentration and spatial distribution of deposited atoms over the surface of the nanosystem on the atomic structure and morphology of the nanosystem. The studies were carried out by the molecular dynamics method using the many-particle potential of the modified immersed atom method. The temperature in the calculation process was controlled using the Nose-Hoover thermostat. The simulation of the formation of atomic nanolayers by the method of alternating directional deposition of layers of different compositions under high vacuum and stationary temperature conditions is performed. As a result of the studies, the structure and thickness of the formed nanolayers and the distribution of elements in the area of their interface were studied. It is shown that alternating layers of the formed layered nanosystem and their interfaces have a significantly different atomic structure depending on the main parameters of the technological regimes of the formation of layered nanosystems.