

Theoretical investigation of stable formation conditions for $\text{Fe}_x\text{Ni}_{1-x}$ alloy films on paramagnetic substrate.

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This work is devoted to theoretical investigation of the adsorption of permalloy-like thin films on the different non-magnetic materials, such as Ag and W. For theoretical description we applied the method of multi-parameter test functions the parameters of which are determined by the numerical minimization procedure of the interfacial energy functional in the subsurface region. In this paper we apply the method of calculation of the energy characteristics of the non-activated adsorption ferromagnetic films based on the method of spin-density functional taking into account temperature effects and inhomogeneous distribution of magnetization [1].

We calculated formation condition of stable $\text{Fe}_x\text{Ni}_{1-x}$ alloy films, depending on the component concentration x of the film. The equilibrium vacuum gap D_{\min} and the equilibrium film thickness h_{\min} are determined from the minimum of the total interfacial energy [2]. The energy and magnetic characteristics of $\text{Fe}_x\text{Ni}_{1-x}$ films on close-packed W and Ag surfaces are calculated in dependence on concentration x for different temperatures.

T, K	Θ	X, %
0	0,8	40
100	0.7	0-40
	0.8	40-80
	0.9	100
300	0.8	80-100
	0.9	60-80
	1	40
400	0.9	80-100
	1	80

Table 1. Conditions for formation of stable $\text{Fe}_x\text{Ni}_{1-x}$ film on Ag(111) substrate.

An analysis of results of investigation suggested that $\text{Fe}_x\text{Ni}_{1-x}$ films cannot form on close-packed W, Ag at low values of Θ and the realization of an energetically more advantageous island adsorption is predicted.

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References

- [1] Mamonova M.V., Prudnikov V.V., Prudnikova I.A., Surface Physics. Theoretical Models and Experimental Methods. - CISP, CRC Press, Taylor & Francis Group, 2013.
- [2] Pilipenko D.V., Mamonova M.V., Prudnikov V.V. "Adsorption and Magnetic Properties of Ultrathin Fe and Ni Alloy Films with an Inhomogeneous Magnetization Distribution" Book of Abstracts of Moscow International Symposium on Magnetism (MISM 2014), p.158-159, 2014.