

## ABSTRACT

Master's dissertation: 119 pages, 18 tables, 42 figures, 63 references.

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Object of research – the processes of structure and phase composition formation in nanoscaled  $\text{Fe}_{50}\text{Pd}_{50}(5-x \text{ nm})/\text{Cu}(x=0 \text{ nm}; 0,3 \text{ nm}; 0,6 \text{ nm}; 0,9 \text{ nm})$  films compositions sputtered on  $\text{SiO}_2(100 \text{ nm})/\text{Si}(001)$  substrates are annealed in vacuum and hydrogen atmosphere.

Objective – the investigation of the phase composition, structure and properties of nanoscale films FePd additional layer of Cu after annealing in vacuum and hydrogen atmosphere.

Methods of sputtering and research – magnetron sputtering, X-ray phase analysis, atomic-force microscopy, SQUID-magnetometry, Rutherford Backscattering.

Scientific novelty:

1. It's found that annealing in hydrogen  $\text{Fe}_{50}\text{Pd}_{50}/\text{Cu}$  film compositions formation of  $L1_0$ -FePd with magnetic properties in structure occurs faster in contrast to during long-term annealing (20 hours) in vacuum. The change of phase composition and structure at diffusion processes during annealing in hydrogen can be characterized by three stages:

I. During 30 min of exposure at  $650 \text{ }^\circ\text{C}$  the destruction of bonds between FePd and Cu atoms replace mainly Pd atoms in the nodes of the lattice and hydrogen atoms penetrate in the lattice pores FePd alloy, which leads to A1-FePd phase with distorted lattice and formation of hydrogen solid solution  $\alpha$ -Pd-H.

II. During 1 hour exposure at  $650 \text{ }^\circ\text{C}$  Pd atoms in the lattice are starting to order A1- FePd lattice and formation  $L1_0$  -FePd phase take place.

III. With longer annealing within 2 hours the accumulation of hydrogen in the film leads to break of bonds Fe, Pd and Cu, defects formation in the lattice and the destruction of solid magnetic  $L1_0$  -FePd phase.

2. Fe<sub>50</sub>Pd<sub>50</sub>(4, 4 nm)/Cu (0,6 nm) film compositions after annealing in hydrogen duration of 1 hour, 650 °C are found to be the optimal conditions for the formation of *L1<sub>0</sub>* ordered phase with magnetic properties H<sub>c</sub>(2,9 kOe), M<sub>s</sub>(704 kA/m) and with more pronounced texture (001) in the direction perpendicular to the substrate.

3. Introduction of additional of Cu layer thickness of 0,3 nm and 0,6 nm in FePd/Cu film compositions does not increase the roughness of diffusion processes in the formation *L1<sub>0</sub>*-FePd phase.

The practical importance – obtained results have practical importance for the development of new materials as promising magnetic recording medium with ultrahigh density.

NANOSCALED FILM COMPOSITIONS; EASY MAGNETIZATION AXIS;  
ULTRAHIGH DENSITY MAGNETIC RECORDING; MAGNETIC ANISOTROPY; *L1<sub>0</sub>*-  
FePd PHASE; STRUCTURE AND PHASE TRANSFORMATION