Nanoobjects microscopy

The structure and phase composition of nanocrystalline Ru films

A.M. Lohvynov[1], I.V. Cheshko, S.I. Protsenko, O.V. Kovalenko, D.M. Krekshyn

[1] Sumy State University. Rymskogo-Korsakova st. 2, Sumy-40007, Ukraine.
E-mail: andreylogvinovsumdu@gmail.com

Thin films Ru are part of a series of synthetic nanosystem with improved physical properties. Quite a wide application in modern electronics and sensor technology have become functional synthetic antiferromagnetic (SAF) layer based on Ru and Co. For more efficient use required a clear understanding of their structure and phase composition in a wide range of thicknesses and operating temperatures [1-2].

The results of the study structure-phase state by electron and transmission electron microscopy (TEM) of single-layer Ru films (thickness range of 10 to 90 nm) and obtained by electron-beam deposition in vacuum (10^{-4} Pa) on carbon film thickness of 20 nm.

Established that single-phase composition of the samples observed only when $d_{Ru} \geq 40$ nm and corresponds HCP - Ru lattice parameter of $a_{Ru} = 0.270$ nm, which is close to the tabular value. In the thickness range 10 – 30 nm on the electron are noticeable lines corresponding HCS phase RuO_2. It is shown that the absence of the oxide phase RuO_2 facilitates substrate heated to 573 K during the formation of the samples. HCP- no trace of Ru oxide can be obtained by $d = 40$ nm on the heated substrate, followed by heat treatment to a $T_a = 900$ K. Samples with $d < 35$ nm regardless of the substrate temperature and heat treatment are homogeneous amorphous labyrinth structure with poor contrast, which does not change during annealing of the estimated value of the average grain size of 5 nm. The crystal structure of samples at $d_{Ru} \geq 40$ nm is almost independent of sample thickness (average grain size matters L_{av} 15 – 10 nm). You can see that during annealing of samples for $T_a = 900$ K due to recrystallization processes increases contrast images of crystal structure.

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1. *Cheshko I.V., Lohvynov A.V.* Formation of nanostructures instrument spin-valve type based on Co and Cu // J. Nano.- Electron. Phys.-2016.-**8**.-P. 03041.
2. *Bueno T. E. P., Parreiras D. E.* // Appl. Phys. Lett.-2014.-**104**.- P. 242404.