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Plasma processing of nanostructured Ni/Al/Co Films

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Nanostructured Ni/Al/Co films for magnetoresistive applications were prepared using mechanical alloying powders prepared at the National Research and Development Institute for Electrical Engineering, Bucharest, Romania as well as simultaneous depositions of Ni, Al and Co using the original thermionic vacuum arc (TVA) method developed at National Institute for Laser, Plasma and Radiation Physics [1].

The method uses an electron beam emitted by an externally heated cathode (grounded tungsten filament) accelerated by the high anodic voltage. The electron beam evaporates the anode metal composite as neutral metal atoms. Applying high voltage (1-5kV) between cathode and anode, bright plasma in pure vapor metal atoms was ignited. The plasma was controlled by the electron beam intensity (thermoelectrons) emitted by the heated cathode.

The process parameters (discharge current and plasma potential) were studied and optimized.

The Ni-Al-Co films were identified by transmission electron microscopy (TEM) as inter-metallic complex of nanocrystals of 5-10 nm average diameters. The prepared samples were characterized also by scanning electron microscopy (SEM), electron dispersive spectrometry (EDS), X-ray diffraction (XRD), atomic force microscopy (AFM), and magnetic force microscopy (MFM).

References

[1] C. P. Lungu, I. Mustata, G. Musa, et al., Surf and Coat. Techn. 200, 399 (2005).