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MgF_2-Co magneto-resistance granular thin films prepared by thermo-ionic vacuum arc technique

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MgF_2-Co magneto-resistance granular thin films presenting TMR effects were prepared by thermo-ionic vacuum arc (TVA) method [1] with the simultaneous ignition of plasma in MgF_2 and Co vapors, respectively. The processing method is suitable for the simultaneous preparation of films of different relative content of Co in the MgF_2 insulating matrix.

Morphologic, structural and magnetic behaviors were analyzed in as prepared and annealed samples. The influence of the Co content on the magnetic properties of the prepared films was analyzed, in correlation with tunneling magneto-resistance (TMR) effects.

The proportionality coefficient was defined as: $TMR = (R_a-R_p)/R_p$, with R_a and R_p the resistances of the system in anti-parallel and parallel configuration of the ferromagnetic layers. This proportionality coefficient depends in a specific way on the geometrical/ structural parameters of the TMR structures [2, 3].

The tunneling magneto-resistance effect is maximal for certain Co content. This behavior was interpreted by the contrary effects of decreasing the average size of the magnetic grains, and hence the average inter-grains distance at higher Co relative content, and the enhanced magnetic disorder in very fine grains dispersed in the insulating matrix. This mechanism was suggested by the comportment of as prepared and thermally annealed samples.

References:

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