

KN0300

High quality hard magnetic films deposited by hollow cathode processes

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Sputter deposition of magnetic material has to overcome challenges due to short circuiting the magnetics of the magnetron cathode. Hollow cathode processes in contrast require no magnets at all to enhance the ionization. Therefore, the high rate deposition of magnetic films becomes possible. The hollow cathode glow discharge can either be utilized for a sputter process where material is sputtered inside a hollow geometry and transported towards a substrate by an intense argon flow (Gas Flow Sputtering, GFS), or the substrate itself is inserted into the hollow cathode glow discharge (Inside Hollow Cathode Process, IHC).

Results of both processes for the deposition of hard magnetic CoSm coatings will be discussed. In the case of GFS, the magnetic properties are influenced by independent parameters, especially ion bombardment and substrate temperature produced by external heating. In the case of IHC, substrate heating results from the intense glow discharge and thus the parameters temperature, growth rate and ion bombardment are dependent on the discharge power. Process conditions and the resulting process properties will be discussed. As one example, we applied hollow cathode processes to deposit thick rare-earth hard magnetic films for a precise angular positioning system on a commercial ball bearing.

Keywords

hollow cathode process

magnetic film

CoSm

magnetic properties

high rate deposition