

High performance hard magnetic films

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Rare Earth – Transition Metal (RE-TM) permanent magnets are used in applications that require magnets with high energy densities and/or high coercivities. A domain of application of major and growing importance concerns high performance motors, such as the motors used in hybrid electric vehicles or those used in gearless wind turbines. Following recent issues with the sourcing and pricing of RE metals, much effort is now going into reducing and ultimately eliminating the need for heavy RE (Dy, Tb) in the bulk Nd-Fe-B based magnets presently used in these applications. At the same time, micro-systems incorporating high performance RE-TM micro-magnets have many potential applications in the fields of energy transformation and management, information technology, bio-medicine... The development of such systems has been hindered to-date by the challenges faced in integrating these materials at the appropriate scale using techniques compatible with today's MEMS technologies.

In this presentation, following a general introduction, I will report on the preparation and study of NdFeB and SmCo films. On the one hand, films serve as model systems to study the development of coercivity in these materials and such studies serve to guide the development of bulk materials [1-4]. I will then present the micro-patterning and local magnetic characterisation of these high performance hard magnetic films, destined for integration into micro-systems [5-7]. Finally, I will give some examples of applications of high performance micro-magnets.

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