# Spin Modulation in Nano-Scaled Magnet for Highly Qualified Spin Related Devices

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Highly qualified spin related devices such as hard disk drive (HD), MRAM, inductor and antenna for high frequency use inevitably requires the recent nanotechnology. Tailor-made spin nano structures in materials made by precisely controlled fabrication technology with nano-scale in each devices are essential from application, together with the further deep understanding of their nanomagnetism.

Exchange coupling induced at the interface CGC and ECC media is necessary for the currently used CoCrPt-$SiO_2$ granular media to solve the Tri-lemma situation, namely to enhance the thermal stability of the bit and also to enhance the magnetic head writability (switching field modulation of the media). Therefore, the degree of direct/indirect exchange coupling among ferromagnetic grains contacted each other at the interface, and also among ferromagnetic grains within a layer is a key to develop a futured high density HD, together with establishment of self-organizing nano dot structure.

For spin-valve devices, exchange bias due to exchange anisotropy induced at the ferro (F)/antiferro (AF) interface is now utilized for the pinned layer. The existence of uncompensated AF spin configuration (surface spin modulation) induced was found to make an important role for the magnitude of exchange anisotropy. That is, the much deeper understanding of the mechanism of exchange anisotropy should be necessary to improve the thermal stability and the TMR ratio, with retaining high crystallization of ultra thin MgO barrier layers with low RA ($< 1\Omega/\mu m^2$).

With the progress of IT technology, excellent high frequency response of magnetization in ferromagnet becomes now a crucial issue. Superparamagnetism originating from high thermal random field in nanoparticle assembly and/or strong magnetic dipole filed between isolated nanoparticles could achieve a high magnetic resonance frequency in GHz-band over the intrinsic ferromagnetic resonance frequency (break through of the Snoek's limit).

Within the frame work of the present paper, tailor-made spin modulated nano structured material and its macroscopic magnetic properties developed for each categorized research items mentioned above will be widely discussed in connection with their own nanostructures.