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Magnetic Property in Permalloy/Ru(V)/Permalloy Synthetic Ferrimagnetic Layers.

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The magnetic random access memory(MRAM) of high density, non-volatility and high speed has been developed even sub-0.5 ㎛ cell size, comparable to dynamic random access memory(DRAM). According to increase of MRAM cell density, many practical problems of noise by stray-field and spin-flipping hindrance by shape anisotropy. We fabricated NiFe based synthetic ferrimagnetic layers(SyFLs), having Ru or V exchange coupling layers to overcome above problems as well as embody sub - 10 Oe coercivity.

We fabricated SyFL of Ta(50Å)/NiFe(50Å)/Ru(4~20Å),V(6~20Å)/NiFe(30Å)/Ta(50Å) with an inductively coupled plasma(ICP) helicon sputter. We measured the magnetic properties of coercivity(H_c) spin-flopping field(H_{sf}) and saturation magnetization(H_s) by a superconduction quantum interference device(SQUID) at the temperature of 4 K and 300 K, respectively. We annealed the samples by a rapid thermal annealing(RTA) at 525 K for 1hr. Then, cross-sectional microstructure and in-plane surface roughness were observed with a transmission electron microscope(TEM) and a scanning probe microcope(SPM), respectively.

All SyFLs showed the sub 10 Oe coercivity. V-SyFLs showed a exchange coupling only at the 8Å-thickness V, while Ru-SyFLs showed periodic exchange coupling at all the Ru thickness range. Annealing did not affect the microstructure and surface roughness at 525K for 1hr. Cross-sectional TEM revealed that V could intermix with Ni and Fe easily, while Ru kept stable interface.

Our result implies that Ru-SyFLs may be appropriate for MRAM application due to small switching field, enough thermal stability, and wide process window.

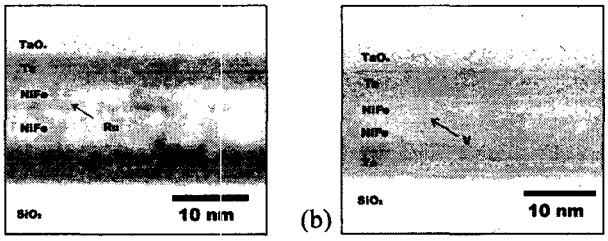

Fig. 1. Cross Sectional TEM images of the (a) Ru(12Å)-SyFL, and (b) V(12 Å)-SyFL

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