Ni nanotubes within porous silicon

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Metal-nanostructures are electrodeposited within the pores of porous silicon to achieve a hybrid material with specific magnetic properties. The metal structures can be precipitated with various geometries and different spatial distributions depending on an accurate control of the deposition conditions. Also small Ni-particles (36 nm) can be deposited in a densely packed arrangement on the pore walls forming a quasi metal-tube. Analysis of this tube-like arrangement by TEM shows that the distribution of the Ni-particles is quite narrow, meaning a distance between the particles smaller than 10 nm. Such a close arrangement of particles assures magnetic interactions between them. Due to their size these Ni-particles are superparamagnetic but dipolar coupling between them results in a ferromagnetic behaviour of the whole system. To investigate the interface in detail EELS is employed, whereas in using multiple linear least square fitting procedure, EELS fine-structure and absolute edge energy information can be added to map the oxygen bounded in different phases (SiOx, metal-oxide). Magnetic measurements show an anisotropy between easy axis and hard axis magnetization corresponding to the behaviour of a metal-tube. This composite is an interesting candidate for integrable magnetic and magneto-optic devices and also for spin-injection from a ferromagnet into silicon.

9.7 cm

13.4 cm

Subject category :

5. Nano-structure, Surfaces, and Interfaces

Presentation mode :
poster

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