Nanostructured Silicon – a Versatile Host Material
Applicable as Biomedical, Magnetic and Optical Material

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This presentation deals with the utilization of nanostructured silicon for deposition of various metals, especially magnetic ones, within the pores/tubes. The novel magnetic properties of the semiconducting/magnetic composites which arise due to the nanoscopic size of the used materials are investigated with respect to biomedical and magnetic on-chip applications.
One of the key topics is the deposition of hard and soft magnetic materials within the nanostructures, aiming in the fabrication of arrays of permanent nanomagnets is shown [1]. Here the investigation of the magnetic behavior of bi-metal nanostructures within nanostructured silicon (figure 1) with the aim to exploit the magnetic properties of both metals and gain control of the exchange coupling between the two metals especially with respect to their volume ratio is discussed. Furthermore, a variation of the structure size and the proximity of the metal deposits modify the exchange coupling and thus the energy product. Nanocomposite systems with an energy product as high as possible should be achieved to give rise to on-chip applications using permanent nanomagnets, especially arranged in arrays.
A further issue, luminescent porous silicon loaded with magnetic metals to enhance the photoluminescence, is addressed with the final aim to influence/control the optical properties by a magnetic field. The metal deposits affect the optical properties but also give rise to specific magnetic behavior [2]. Due to the metal filling of the porous silicon the photoluminescence is blue-shifted and furthermore an increase of the intensity is observed. The influence of the magnetic metal filling on the optical properties (photoluminescence, decay time) is discussed and the magnetic characterization of the nanocomposits is presented.

References

[1] K. Rumpf, et.al, Phys. Stat. Sol. A, 217 (2020) 1901040
[2] P. Granitzer, et al, Frontiers in Physics, 8 (2020) 121

Figures

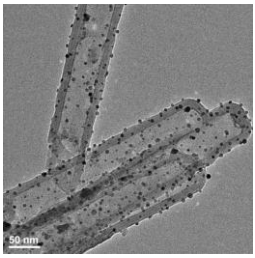

Figure 2: SiNTs loaded with FePt nanoparticles with an averade size of 5 nm.