Fabrication of nanoscale magnetic rings, dots and rods on solid substrates by shadow nanosphere lithography

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Shadow Nanosphere Lithography (SNSL) is a low-cost, time-efficient method used for preparation of large-area, two-dimensionally ordered particle arrays. It utilizes monolayer of polymer spheres as a mask for metal evaporation process.

The control over the apertures in the mask by its temperature processing and silica coating will be presented as well as example templates of particles downscaled from 200 to 30 nm, with preserved original nanosphere spacing. Variation of the geometry of evaporation setup during the process allows preparation of the simple morphologies such as ring, rod, and dot-shaped particles. Experimental results are confirmed by computer simulations, which also show the possibility of creating periodic arrays of any other simple geometrical shapes. The 150-nm-diameter Fe rings produced by this method show ferromagnetic behavior, predicted by theoretical simulation.

The templates are characterized by the size, spacing and shape of the particles. Control over these conditions is very important in nanodevice designing as well as in ground research. SNSL allows an outstanding control of the size and morphology of metallic, and magnetic particles, in comparison to its "older sister" – Nanosphere Lithography (NSL), where the size of the triangle-shaped particles depends only on the spacing in the template.

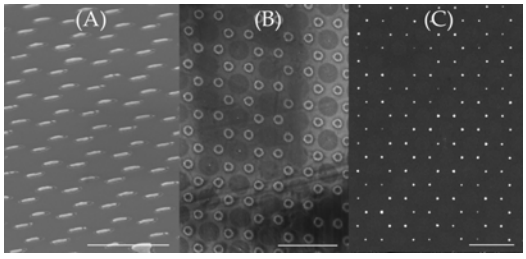

Fig. 1. (A) Au rods on silicon sustrate, (B) Fe rings on silicon substrate and (C) Fe dots on silicon substrate, evaporated through decreased apertures using shadow nanosphere lithography. The scale bars are 1μm

[1] A. Kosiorek, W. Kandulski, P. Chudzinski, K. Kempa, M. Giersig, Nano Letters **4** (2004) 1359.
[2] A. Kosiorek, W. Kandulski, H. Glaczynska, M. Giersig, Small **4** (2005) 439.

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