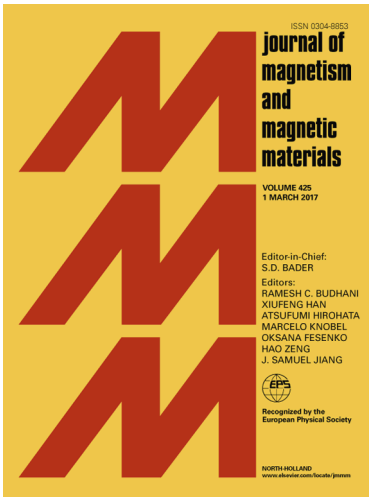

Enhanced mobility of iron nanoparticles deposited onto a xenon-buffered substrate

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Enhanced mobility of iron nanoparticles deposited onto a xenon-buffered substrate

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Abstract

The growth of nanoparticles from the gas phase in combination with deposition under ultrahigh vacuum conditions enables one to obtain pure and mass-selected nanoparticles with variable particle density from a wide range of materials on virtually any solid support and is therefore of great interest for many applications. While the magnetic, chemical, and optical properties of such deposits are intensively investigated, less work has been undertaken so far to achieve ordered arrangements of nanoparticles deposited from a cluster beam. In this work we demonstrate a first step towards the control of nanoparticle spatial distribution for iron nanoparticles with a size of about 12 nm. We find that while deposition onto a bare Si substrate results in a random distribution of isolated nanoparticles, the introduction and subsequent desorption of a Xe buffer layer induces mobility and agglomeration of nanoparticles on the Si surface. The agglomerates are extended and exhibit a height equal to about 15 nanoparticles. The vertical growth of the agglomerates is assigned to the presence of a magnetic field which was applied perpendicular to the substrate surface. We suggest that by tuning the magnetic field and deposition conditions, the spatial arrangement of magnetic nanoparticles could be controlled.

Keywords: Fe nanoparticles, nanoparticle diffusion, Xe buffer, cluster deposition

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Finding new venues for enabling and controlling the arrangement of nanoparticles is key for many applications. Self-ordering phenomena occurring during controlled evaporation of colloidal solutions have been successfully used to create ordered nanoparticle

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