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Real-time imaging of magnetic-field gradient directed self-assembly of magnetic nanoparticles into patterns using magnetic recording media[1] THOMAS CRAWFORD, MATTHEW CHAPMAN, LONGFEI YE, University of South Carolina, O. T. MEFFORD, Clemson University — We employ enormous magnetic field gradients at the surface of disk drive media to self-assemble ferrite nanoparticles from a colloidal fluid onto the medium surface. Thus we "nanomanufacture" a user-programmed and magnetically-recorded pattern with demonstrated 25 nm precision. Using a low-noise CCD camera for bright-field microscopy with a 40x water dipping lens, we demonstrate real-time optical imaging of the pattern formation. By introducing concentrated ferrofluid to a water solution covering the recording medium, we observe both diffusion of the ferrofluid as well as self-assembly of nanoaprticles onto the magnetic field pattern recorded on the disk. The average intensity of the nanoparticle pattern increases exponentially and then saturates, while the overall brightness of the image decreases exponentially, over both patterned and unpatterned regions. These results hint at interesting nanoparticle dynamics during the initial ferrofluid diffusion and after the nanoparticle assembly process occurs on the disk medium surface. We suggest real-time optical microscopy can help explain the dynamics of colloidal magnetic nanoparticles in the presence of extreme magnetic field gradients which are not employed in typical magnetophoretic assembly.

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