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Self-assembly of Superparamagnetic Nanoparticles with Permanent Magnetization[1] SUVOJIT GHOSH, ISHWAR PURI, Virginia Tech — Magnetic nanoparticles (MNPs) exhibit superparamagnetism when thermal fluctuations overcome the potential barrier for spin reversal set by magnetocrystalline anisotropy. The magnetic moment in such a material oscillates between the easy axes leading to zero net magnetization. Stable colloidal dispersions of MNPs exploit this state to prevent agglomeration. Self-assembly of MNPs presents an excellent bottom up nanofabrication technique due to the wide range of structures that can be formed. A stable dispersion of MNPs is an essential starting point for good control of the process. In this study we explore the theoretical basis for a self-assembled MNP structure with permanent magnetization starting from a dispersion of superparamangetic MNPs. Magnetostatic coupling of dipole moments enhance the potential barrier for magnetization reversals. We use X-Ray microCT and TEM to visualize the self-assembled structures. We use a stochastic form of the Landau-Lifshitz-Gilbert equation to simulate the magnetization dynamics in each MNP. Permanent magnetization in self-assembled structures generated *in situ* promise several significant applications such as targeted drug delivery, tissue engineering and novel soft composites.

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