Tunable lattice of a photonic crystal comprised of ferro fluid studied by Monte Carlo simulation and optical transmission

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Abstract

The aggregation and rearrangement of nanoparticles embedded in a thin cell of ferrofluid at various applied magnetic fields is studied numerically by Monte Carlo simulation. Regular lattice of magnet micro-columns parallel to the magnetic field was observed with column size depending on the ramp speed of the applied field. The column size decreases as the ramp speed increases attributing to the diminishing time to achieve the final assembling state at a given final magnetic field. A photonic crystal of tunable lattice constant characterizing with various spectroscopic dispersions is elucidated. The hexagonal structure of the aggregation of magnetic nano-particles was observed through an optical microscope. The Result of the simulated spectral distributions by implementing the light source as emanating either from the grating slits or from the magnet columns is the same.
Fig. 2 The regular lattice points formed by the aggregation of nanomagnetic particles resulting from an external ramped magnetic field.

Fig. 5 A 3-D snapshot of 500 MMP after 1000 MC steps.
Fig. 7 Simulated Interference pattern using the simulated points in fig. 2(a) as the coherent light sources. Contours of the intensity are shown below.
Fig. 10 The (a) experiment and (b) simulated transmittance pattern with various wavelengths using the points in fig. 2(a) as the coherent light sources.