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Computational and experimental study of magnetic colloidal assembly and martensitic transition LIN FU, YE YANG, CATHERINE MARCOUX, JOSHUA SOCOLAR, PATRICK CHARBONNEAU, BENJAMIN YELLEN, Duke Univ — Colloidal self-assembly in external fields offers new ways to build up complex structures. Here, we study the self-assembly of a quasi-2D mixture of magnetic and non-magnetic spherical particles, immersed in a ferrofluid and under an external magnetic field. We calculate the external field strength-density-tilt angle phase diagram for the system by specialized Monte Carlo methods and compare the results with experiments. By tilting the external field away from the vertical, the system first undergoes magnetostriction, and then a martensitic phase transition between a checkerboard and a striped crystal. We find that the out-of-equilibrium transformation pathway depends strongly on the initial crystal orientation, external field strength and degree of confinement in the third dimension. Our findings suggest the possibility for improving the design of functional materials by selecting the specific type of transformation pathway to optimize either the shape change or the heat exchange properties.

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