Abstract Submitted
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Micromagnetic Modeling of Reversal Nucleation in Core/Shell Exchange-Spring Structures[1] J.S. JIANG, SAM BADER, Argonne National Laboratory — Nanocomposite exchange-spring permanent magnet materials promise superior performance and are a potential solution to the supply criticality in rare earth elements [1]. The nucleation of magnetization reversal in cylindrical and spherical soft core/hard shell exchange-spring structures has been investigated by solving the linearized Brown's equation perturbatively, and has been verified with numerical simulations [2]. Accounting for the magnetostatic self-interaction field leads to a modification to the proposed quasi-coherent "bulging" mode[3] of nucleation for small core sizes. The modified curling mode, where the magnetization configuration is vortex-like and flux-closed, becomes favored at large core sizes. The mode crossover occurs at a core diameter of approximately twice the exchange length for the cylindrical geometry. Since flux-closure allows magnetic elements to be densely packed without affecting the nucleation field, a potential direction for improving permanent magnet materials is to induce the modified curling mode by creating a soft-cylinder-in-hard-matrix exchange-spring microstructure.

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