Phase Diagram of 360° Domain Walls in Magnetic Rings

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Abstract	One method to increase bit density in magnetic memory devices is to use multi-state structures, such as a ferromagnetic nanoring with multiple domain walls (DWs), to encode information. However, there is a competition between decreasing the ring size in order to more densely pack bits and increasing it to make multiple DWs stable. This paper examines the effects of ring geometry, specifically inner and outer diameters (ODs), on the formation of 360deg DWs. By sequentially increasing the strength of an applied circular magnetic field, we examine how DWs form under the applied field and whether they remain when the field is returned to zero. We examine the relationships between field strength, number of walls initially formed, and the stability of these walls at zero field for different ring geometries. We demonstrate that there is a lower limit of 200 nm to the ring diameter for the formation of any 360deg DWs under an applied field, and that a high number of 360deg DWs are stable at remanence only for narrow rings with large ODs.
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