Magnetic skyrmion state stability in ultrathin cylindrical dots

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The stability of the skyrmion magnetization configurations in ultrathin circular magnetic dots is calculated analytically and simulated micromagnetically accounting realistic magnetic and geometrical dot parameters taken from recent experiments. The Dzyaloshinskii-Moriya exchange interaction (DMI) is accounted as an interface term. We simulated the Neel skyrmion stability in circular dots of radius R=50 nm and 250 nm and thickness of L=0.6 nm using the OOMMF code. The area of the Neel skyrmion stability/metastability, skyrmion magnetization profiles and the equilibrium skyrmion radius are found in the terms of the dot magnetic (perpendicular anisotropy constant, saturation magnetization, DMI strength etc.) and geometric parameters (R, L). It was shown that the Dzyaloshinskii criterion of the instability of ferromagnetic state in bulk ferromagnets should be essentially modified to describe stability of the magnetic skyrmions in 2D systems like ultrathin ferromagnetic films and dots.