CALIXARENE-ENCAPSULATED COBALT NANOPARTICLE RINGS

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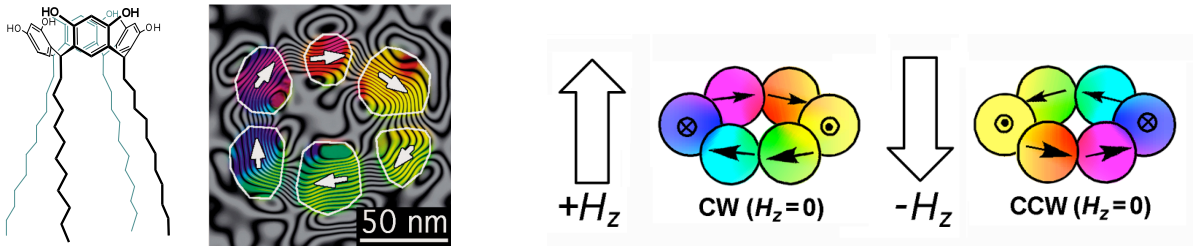
Calixarenes are excellent encapsulating agents for metal and inorganic nanoparticles, and can mediate their self-assembly into functional nanostructures with intriguing collective materials properties.[1] In this presentation we discuss the self-assembly and chiral flux closure (FC) states of Co nanoparticle rings, and their potential for nonvolatile memory applications. Weakly ferromagnetic Co nanoparticles are synthesized and dispersed in the presence of C11 resorcinarene, and have a strong tendency to self-assemble into rings containing 5–10 particles.[2,3] The magnetic FC states in the Co nanoparticle rings can be imaged by a TEM technique known as electron holography,[4] and have been shown to exist as a "racemic" mixture at room temperature. The Co nanoparticle rings have the remarkable ability to reverse their FC states upon exposure to a coaxial magnetic pulse (H_z).[5] This switching phenomenon has not been previously observed in other magnetic structures, but can be reproduced by micromagnetic simulations and appears to be unique to the Co nanoparticle rings.



Left, Electron holography image of magnetic FC state at 298 K (H = 0 Oe) in 6-membered ring of Co nanoparticles encapsulated by C11 resorcinarene. *Right*, FC states can be switched by applying a coaxial magnetic pulse (H_z). The FC polarizations are described by arrows and a color-wheel scheme (red=right, yellow=down/out, green=left, blue=up/in).

References:

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[3] Tripp, S. L., Dunin-Borkowski, R. E., and Wei, A. (2003). Flux closure in self-assembled cobalt nanoparticle rings. Angew. Chem. Int. Ed. *42*, 5591-93.

[4] Dunin-Borkowski, R. E., Kasama, T., Wei, A., Tripp, S. L., Hytch, M. J., Snoeck, E., Harrison, R. J., and Putnis, A. (2004). Off-axis electron holography of magnetic nanowires and chains, rings and planar arrays of magnetic nanoparticles. Microsc. Res. Techn. *64*, 390-402.

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