Magnetic Nanohybrids for energy storage applications

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Maximum energy product $(BH)_{max}$ is used to evaluate the energy-storage ability of a permanent magnet and defined by the area of the largest rectangle that can fit inside the second quadrant of a B– H loop derived from the M–H loop via the relation of $B = u_0M + H$. (Figure 1). Generally, both high remnant magnetization (Mr) and high coercivity (Hc) are crucial for permanent magnets to have high $(BH)_{max}$. However, high magnetic moment and large coercivity are incompatible in single-phase magnets. Magnetically soft materials (Fe, Co, or FeCo) have very high magnetic moment, but their coercivities are low (<1 kOe), which makes the unsuitable for as energy storage applications. Nanocomposite magnets consisting of both magnetically soft and hard phases that interact by magnetic exchange-coupling across the interface are promising systems to achieve maximum energy products far beyond the limit of single-phase magnets [1-2]. An exchange coupled magnetic nanocomposite retains both the high magnetization from the soft phase and the large coercivity from the hard phase, and exhibits a smooth, single-phase-like hysteresis behavior. In the present poster, I will highlight the recent advances in the synthesis and characterizations of magnetic nanohybrids consist of soft magnetic core and hard magnetic shell or vice versa and their importance for energy storage applications.

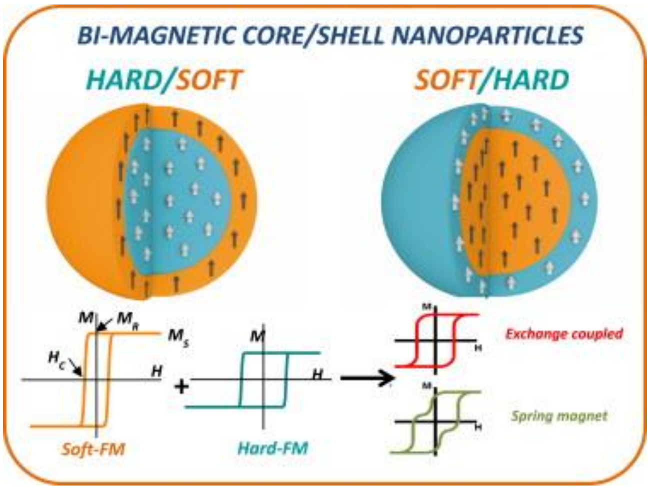

Figure 1 Schematic illustration of hysteresis behavior of a nanocomposite magnet consisting of both magnetically soft and magnetically hard phases that interact by magnetic exchange coupling across the interface.

References:

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2. Estrader M, López-Ortega A, Estradé S, Golosovsky, Salazar-Alvarez G, Vasilakaki M, Trohidou KN, Varela M, Stanley DC, Sinko M, Pechan MJ, Keavney DJ, Peiró F, Suriñach S, Baró MD, Nogués J, Nat. Commun. 2013; 4, 2960