A simple method for measuring intrinsic blocking temperature in superparamagnetic nanomaterials

ABSTRACT

Temperature-dependent magnetic flux density (B) data, clearly exhibiting a transition temperature called intrinsic blocking temperature for some metallic samples in zero field cooled-warmed (ZFC-W) curves without employing an external magnetic field, has been obtained by a simple method. The reasons of the increase and decrease in the measured B-field at low temperature in zero magnetic-field were discussed. Co, CoPt3 and Co/Au, CoPt 3/Au core-shell nanoparticles, prepared by the reverse-micelle microemulsion method, were used as test materials. The blocking temperature was measured at a cusp of the measured magnetic field, B (produced by the sample), versus the temperature curve during warming up of the sample from a very low temperature (Ò15 K) to room temperature. All the samples showed a blocking temperature at 45, 50, 40, and 42 K, respectively, for Co, CoPt3, Co/Au, and CoPt3/Au nanoparticles. A completely intrinsic behavior of the sample's magnetic moment was revealed by our method since no applied external field was used, yielding a truly spontaneous magnetization behavior.

Keyword: Anisotropy energy; Intrinsic blocking temperature; Magnetic flux density; Magnetic moment; Superparamagnetism; Zero field cooled-warmed