Effect Of Shape Anisotropy In Magnetic Properties Of $BaFe_{12}O_{19}$ Nanocrystalline Systems

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The M-type hexagonal $BaFe_{12}O_{19}$ (BaHF) is a ferrimagnetic material below (T_C) 720 K and is widely utilized for the production of permanent magnets due to its high saturation magnetization, strong uniaxial crystalline anisotropy and large coercivity [1, 2]. The above mentioned magnetic parameters makes BaHF suitable as a permanent magnetic material in numerous applications, like microwave devices, high density magnetic and magneto optical recording media etc. Fe^{3+} exists in five different crystallographic sites with different coordination number in this compound which gives an opportunity to tune the magnetic parameters by substituting different cations at various Wyckoff positions in its structure. The coercivity values (which comes from the total magnetic anisotropy of BaHF) are higher when compared to materials used in real time applications in magnetic recording media. This is the disadvantage of BaHF to use it for such a purpose. Researchers are attempting to reduce the coercivity values without much affecting the saturation magnetization by substituting Co^{2+} and Ti^{4+} in Fe^{3+} sites [3, 4]. The shape anisotropy plays an important role in nano-structured materials which controls the total magnetic anisotropy to large extent. We have synthesized different morphologies and sizes of BaHF in nanocrystalline form using high purity native nitrates by auto ignition method. We have chosen nanorods with different lengths from 80 to 300 nm and thickness varies from 20 to 80 nm. Hystereses of these nanorods show that the coercivity varies from 190 to 7000 Oe for different shapes and sizes at room temperature. The observed coercivity and saturation magnetization values strongly depend on size and shape of the nano-crystals prepared. The micro structure and influence of the finite size effect and the shape of nano-particles of $BaFe_{12}O_{19}$ on its magnetic properties will be presented and discussed.

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