Martensitic and austenitic transformations in smart nanoparticles with size effects and hysteresis splitting

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We use the Blume-Emery-Griffiths (BEG) model [1] to investigate the magnetic properties of core-surface smart nanoparticles (NPs). We firstly propose a relationship between bond variables (P_{ij}) in pair approximation [2] and the number of spins so that core and surface contributions to total magnetization can be identified for the nanostructured particles [3]. Based on the numerical solutions of P_{ij}, magnetization and hysteresis curves are obtained. Besides the first- and second-order phase transitions, martensitic and austenitic phase regions are observed in the phase diagrams of homogeneous and composite NPs and the origin of martensitic transitions (MT)-austenitic transitions (AT) is investigated. It is found that MT-AT occurred for a nonzero biquadratic exchange parameter. On the other hand, nonzero single-ion anisotropy caused the hysteretic splitting in core-surface type nanoparticles.

References:

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