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

R. Erdem, O. Yalçın, and S. Özmü

1 Department of Physics, Akdeniz University, 07058 Antalya, Turkey
2 Department of Physics, Niğde University, 51240 Niğde, Turkey
3 Institute of Sciences, Niğde University, 51240 Niğde, Turkey

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: