

Nanocomposites and nanomaterials

Hysteretic properties of the spin-crossover nanomaterials induced by light irradiation

Iu. Gudyma¹, A. Maksymov^{1,2}

¹ *Department of General Physics, Chernivtsi National University, 2 Kotsjubynskyi Str., Chernivtsi 58012, Ukraine.*

E-mail: yugudyma@gmail.com

² *Advanced Materials Research Institute, University of New Orleans, 2000 Lakeshore Drive, New Orleans, LA 70148, USA.*

The spin-crossover compounds are the new class of coordination inorganic complexes with bistable properties characterized by $d^4 - d^7$ electronic

configuration of metal ion orbitals, situated in the center of the octahedral ligand field [1]. The bistable properties of spin-crossover complexes are related to the existence of low-spin (LS) and high-spin (HS) configuration of degenerated d-orbitals of metal ion, which takes places due to the action of crystal field of the surrounded ligand and lead to the existence of hysteresis loop controlled by external field.

We focused on the hysteretic properties of the spin-crossover systems induced by light irradiation (LIOH – light induced optical hysteresis) in presence of the fluctuation of system parameters described as noise that assumes all background random forces [2-4]. The theoretical description of such kind of nonstationary system dynamics was provided in the framework of Langevin kinetic equation with additive noise action. It was find out that the presence of noise decreases the width of LIOH, showing similar behavior observed before for temperature hysteresis of spin-crossover system [3]. This narrowing is nonlinear and for some threshold noise value it may be observed the collapse of hysteresis loop, which corresponds to the occurrence of the second-order phase transition. The further increasing of noise changes the rate of saturation of system states. It was observed that for non-hysteretic regimes the dynamic potential of the system is maintained bistable.

1. *Halcrow M. A. Spin-Crossover Materials: Properties and Applications.* Chichester: John Wiley & Sons. - 2013. – 564 p.
2. Gudyma Iu., Maksymov A., Dimian M. Stochastic kinetics of photoinduced phase transitions in spin-crossover solids // *Phys. Rev. E.*-2013.- **88**.- P. 042111.
3. Gudyma Iu., Maksymov A., Enachescu C. Phase transition in spin-crossover compounds in the breathing crystal field model // *Phys. Rev. B.*-2014.-**89**.- P. 224412.
4. Gudyma Iu., Enachescu C., Maksymov A. Kinetics of Nonequilibrium Transition in Spin-Crossover Compounds in *O. Fesenko, L. Yatsenko Nanocomposites, Nanophotonics, Nanobiotechnology, and Applications.*- Cham: Springer.- 2015.- 403 p.