International Conference on Advanced Materials, Nanosciences and Applications (ICAMANA 2019) & Training school in Spectroscopies for Environment and Nanochemistry
December 10th-13th, 2019, Oujda-Morocco

The bistable spin transition molecular Solids: from the physical property to the crystal imaging through the phase transition.

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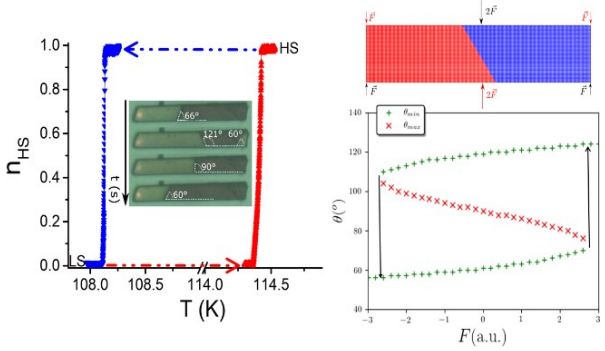
Abstract

There has been in recent years a continuous increase in spatiotemporal investigations [1] of the dynamics of the first-order transitions in spin-crossover (SCO) solids. In single crystals, this phenomenon proceeds via a single domain nucleation and propagation, characterized in some systems with the presence of two equivalent and symmetric interface orientations, between the high-spin (HS) and low-spin (LS) phases, due to the anisotropic structural change of the unit cell at the transition [2]. The present investigations [3] bring an experimental evidence of the reversible driving of the translational and rotational degrees of freedom of the HS−LS interface. In addition to its rectilinear displacement, the interface rotates between two stable angles, 60° and 120°. It is demonstrated that while the translation motion is accompanied by a crystal's length change, the interface rotation is controlled by the crystal's bending. These experimental observations are well-explained in the frame of an elastic theoretical description in which the effect of the crystal bending, on the stability of the interface's orientation, is simulated by applying a moment of forces on the crystal. It is found that the interface orientation becomes unstable beyond a threshold load value, announcing the emergence of a new bistability in SCO solids, taking place at constant HS fraction and volume.

The second part of the presentation will be devoted to the theoretical study of new type of core-shell spin-crossover materials [4-6] in which the core and the shell are made of active spin transition systems having different transition temperature

We will show that the interplay between the electroelastic bistabilities favored by their elastic retroactions. The role of the lattice parameter misfit between the two constituents will be discussed and its effect on the thermal behavior of the resulting high-spin fraction will be identified.



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Biography :

The author is a full Professor of Physics since 2005 in Versailles's University. He is a solid state physicist, expert of equilibrium and nonequilibrium aspects of phase transitions in molecular solids, including spin-crossover systems, Prussian Blue analogs, charge transfer solids (mixed valences) and photo-luminescent hybrid organic-inorganic for which he is currently studying the correlation between their optical and structural properties. The author has also an expertise in real time optical microscopy imaging of phase transitions, and in theory of phase transitions, including elastic models, Monte Carlo simulations, Molecular Dynamics and reaction-diffusion models for spatiotemporal description of phase transitions. He was awarded his PhD in 1993 from the University of Pierre et Marie Curie (Paris VI), France. He published more than 190 papers. His H-index is ~ 34 on Scopus.

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