



## Spin-Crossover Materials

The subject of the book edited by Malcolm A. Halcrow, namely spin-crossover in transition metal compounds, has become increasingly popular over the past decades. Following several review articles in high-ranking journals, the volumes 233–235 in the Springer Series “Topics in Current Chemistry” edited by P. Gütllich and H. A. Goodwin took stock of the state of the art of the research area in 2004. Since then the number of publications on spin-crossover compounds has virtually exploded, with new research groups, experimental techniques and theoretical approaches entering the field, the driving force being potential applications of these compounds as molecular switches in information technology and chemical sensing. Thus an estimated 1500 research articles later, a textbook reviewing the latest developments is most welcome. 21 authors or teams of authors contribute to this formidable task.

The introductory chapter by K. Murray includes historical background information and gives a concise overview of today’s hot topics in this multidisciplinary area. Synthesis is the basis of successful research in material science. Three extensive chapters, by B. Weber of novel mononuclear iron(II) complexes, and by J. Olguin and S. Brooker and by M. C. Munoz and J.-A. Real of polynuclear and polymeric systems, respectively, take care of this. The editor himself elaborates the relationship between structure and function in molecular spin-crossover materials, notably with respect to cooperative effects, and in a colorful chapter on optical microscopy F. Varret et al. show how the latter give rise to first-order phase transitions and related phenomena.

Interesting novel approaches are highlighted in several contributions, notably the combination of luminescence and spin-crossover by A. Bousseksou et al., of liquid crystals and spin-crossover by S. Hayami, of electrical conductivity, magnetic ordering and spin-crossover by O. Sato et al., and, very important in view of potential applications, spin state control at the nanometer scale by M. Ruben et al. It is amazing how finely spin-crossover compounds can be patterned into nanodots, stripes, and thin layers. The chapter on spin-crossover in solution making use of photochemical modifications of the ligand environment by M. P. Shores et al. goes even beyond that by demonstrating the possibility of spin-state control at the molecular level.

The photophysical properties of spin-crossover systems have fascinated many research groups

since the discovery of the light-induced spin state trapping (LIESST) effect in 1984, chiefly because it has been evoked in conjunction with the above-mentioned applications. In this context, J.-F. Létard et al. discuss strategies to optimize the lifetimes of the trapped spin states at elevated temperatures. Very important from a fundamental point of view are the two contributions on the switching processes themselves by M. Chergui in solution using ultrafast optical and X-ray spectroscopies, and by P. Guionneau and E. Collet in the solid state using ultrafast photocrystallography. Taken together these chapters give a comprehensive account of the sequence of events following the initial absorption of a photon, with implications beyond spin-crossover itself.

Two chapters are devoted to theoretical approaches. The phenomenological modeling of cooperative effects by Enachescu et al. gives an up to date account of the authors’ own work. The chapter on quantum mechanical calculations by R. Deeth et al., while pointing out the key challenges involved, is rather summary and does not do justice to the recent advances by the respectable number of research groups working in the field.

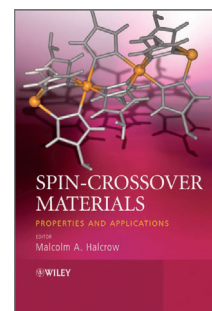
The editor chose to include five contributions which do not treat classical spin-crossover compounds, but they constitute interesting extensions of the concepts to charge transfer induced spin transitions in cyanometalates by K. Dunbar et al., cobalt(II) catecholate tautomeric systems by C. Boskovic, and reversible spin-pairing in organic radicals by J. M. Rawson and J. J. Hayward and in copper nitroxyl complexes by V. Ovcharenko and E. Bagryanskaya, and J.-P. Rueff gives an account of spin-crossover like transitions in metal oxides important in a geological context.

Whereas up to around the year 2000 the experimental methods for studying spin-crossover phenomena were essentially magnetic susceptibility measurements, Mössbauer spectroscopy, X-ray crystallography, and optical spectroscopy, new experimental methods such as micro-Raman scattering, various X-ray absorption spectroscopies, and ultrafast, local-probe and other sophisticated methods are now used and this is evident from the different facets treated in this book. I enjoyed reading it and was rewarded with some new insight into spin-crossover. I consider it a useful text certainly for all those working in the research area of spin-crossover but also for all those generally interested in material science.

Andreas Hauser

Département de chimie physique  
Université de Genève (Switzerland)

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