PhD position

Synthesis, shaping and investigation of the barocaloric refrigeration ability of spin crossover compounds

Funding: ANR Bref

Laboratory: ICMCB, "Switchable Molecules and Materials" group, Bordeaux

Duration: 3 years from October 2024.

Spin crossover (SCO) materials are molecular switches between two electronic states upon the application of an external stimulus such as temperature, light, electric field and pressure. Already investigated applications included sensing and memory devices. Very recently, the huge entropy changes observed whenever abrupt crossovers occur, usually coupled with 1st order phase transitions, evidenced that this class of compound is of utmost interest to be integrated in solid-state refrigeration technology, using either hydrostatic pressure (barocaloric refrigeration) or anisotropic strain (elastocaloric refrigeration) as the driving parameters. Our group has specifically developed an expertise on the fundamental applications of hydrostatic pressure on spin crossover materials and has recently devised a fundamental approach for sintering those soft materials in centimetric sized ceramics.

Accordingly, the project aims first at preparing materials adapted for barocaloric refrigeration, that is that present an abrupt SCO with reduced to non-existant thermal hysteresis, ideally close to room temperature. The synthesis will feed the preparation of ceramics as bulk objects to be characterized. The investigations will cover crystallographic, calorimetric and magnetic properties under variable temperature and pressure to extract their refrigeration ability. All those techniques are available at ICMCB, and specific collaborations at the national (ANR projects) and European level (European Innovation Council Pathfinder Challenge project) are already in place to cover additional investigations.

The selected candidate will be hired by CNRS and will be based at the Institute of Condensed Matter Chemistry of Bordeaux (ICMCB). The "Switchable Molecules and Materials" group has a long-standing expertise in the synthesis and characterization of spin crossover compounds, with a renowned experience in magnetism, crystallography and pressure measurements.

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