Tunable Diffraction Devices Based On Spin Crossover Materials

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The spin crossover phenomenon in transition metal complexes is one of the most spectacular examples of molecular bistability. The switching between the two different electronic states of these molecules can be achieved using various external perturbations like a change of temperature or by applying an external pressure, light irradiation, pulsed magnetic field, and even a change of the concentration of chemical species around the samples. Hence the potential applications of these materials for the construction of sensor and memory devices continue to draw much attention.[1] In our team we have succeeded to elaborate thin films[2] and nanopatterns[3] of these materials displaying room temperature spin crossover. Different methods were developed to detect the spin crossover phenomenon in the films, but these techniques become limited when the film thickness decreases below *ca.* 100 nm (depending on the compound). To overcome this limitation we propose an alternative method where sensing is based on the variation of the diffracted intensity by a periodic pattern of the thin film material due to the change of the optical properties associated with the spin state change.[4] In this presentation, we will discuss the fabrication of surface-relief gratings of the complex [Fe(hptrz)$_3$(OTs)$_2$] by using "soft lithography" methods (micro-molding in capillaries[5]) as well as their physical properties. These spin crossover gratings can respond reversibly to various external stimuli with fast response times. The response can be either transient (gating) or non-volatile (switching) – depending on the compound and on the experimental conditions. We believe that these assets provide a clear technological interest in a variety of applications including optics, photonics and chemical sensors.

References

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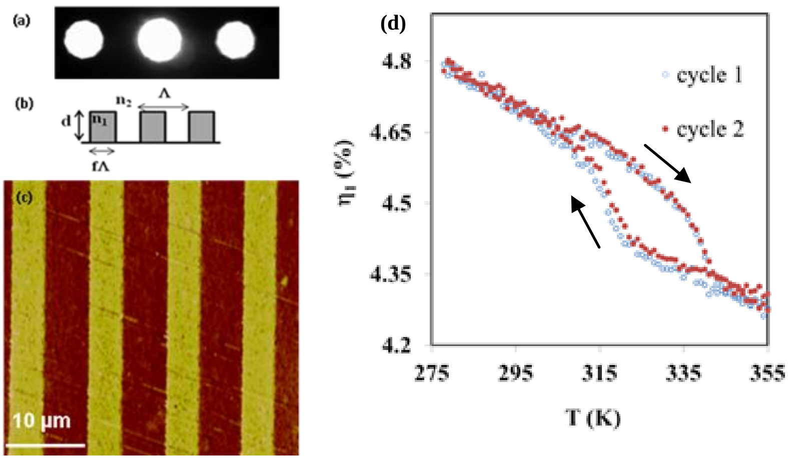

(a) Diffraction pattern of a 100 lines/mm surface-relief grating of the spin crossover complex [Fe(hptrz)$_3$(OTs)$_2$], (b) schematic picture of the grating geometry, (c) its AFM image and (d) the temperature dependence of the diffraction efficiency through two thermal cycles.