chem2Dmat
August 31 - September 03, 2021 ● Bologna, Italy
European Conference on Chemistry of Two-Dimensional Materials

# Switchable Optoelectronic Devices based on Spin Crossover/Graphene Heterostructure

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Spin crossover (SCO) molecular materials exhibit a change of magnetic state that can be triggered by several external stimuli, in particular temperature, pressure, electric field and light irradiation. Despite their important potential, their use in multi-functional devices is hampered by several technological locks: (i) optoelectronic devices remain scarce because of complex intricate phenomena into the SCO channel, (ii) the low intrinsic conductivity of SCO material prevent their use for several sensing applications, (iii) optoelectronic switch based on SCO phenomena and operating at room temperature is not yet demonstrated. Here, I will present some of our recent achievements and on-going works illustrating the possibilities offered by ***SCO-2D materials heterostructures*** **for switchable optoelectronic applications**, and how they can unlock these challenges.

First, magneto-opto-electronic properties are shown for a hybrid device constructed from a spin crossover (SCO) thin film of molecular material evaporated over a graphene sensing layer. The principle of electrical detection of the ***light-induced spin transition*** (LIESST) and reverse-LIESST effects in SCO/graphene heterostructures is demonstrated at low temperature. **[1]** The switchable spin state of the molecular film is translated into a remanent change of the conductance of the graphene channel, using two distinct excitation wavelengths to write/erase the two states.

Then, I will present a hybrid device that can be **optically switched at *room temperature*** with **non-volatile electrical memory effect.** For this molecular system, device operation at room temperature is realized, with multi-state stabilization obtained by varying the irradiation intensity or time. **[2]**

These results reveals the full potential of mixed-dimensional heterostructures for molecular (opto)electronics and spintronics, and opens the door to the use of spin crossover materials for room temperature optoelectronic operations.

## References

**[1]** N. Konstantinov, *Journal of Materials Chemistry C* 2021, 9, 2712.
**[2]** J.F. Dayen et al., *submitted* 2021**.**

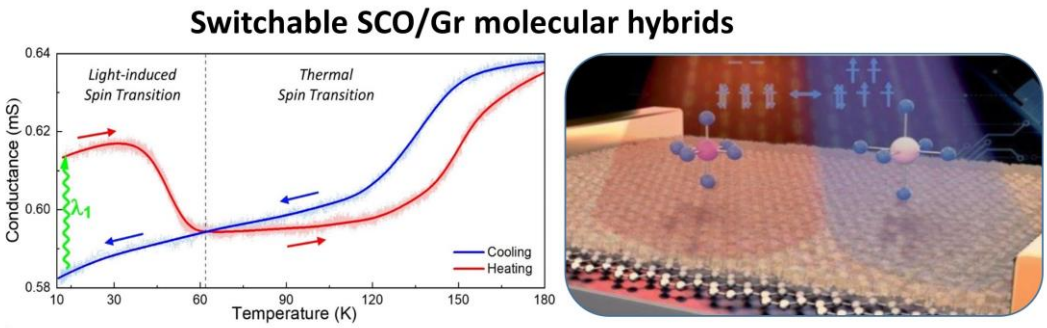


**Figure 1:** ***Left:*** **Light and Thermal Spin transition of SCO molecular thin film detected by a graphene sensor.** ***Right:*** **Artistic view of the experiment.**