CHEMISTRY OF 2D MATERIALS: FROM 2D MOLECULAR MAGNETS TO HYBRID MOLECULAR/2D HETEROSTRUCTURES

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Graphene and other 2D materials are a hot focus of interest in physics, chemistry and materials science. These materials are almost exclusively based on inorganic lattices and cover a wide range of electronic and magnetic properties: from insulators to superconductors, from diamagnetic to ferromagnetic (FM) and from metallic to non-metallic compositions. Except for the chemical functionalization of the surface of the 2D material, molecules have been scarcely considered in this field. In this talk I will emphasize the role of chemistry in this area paying particular attention to the magnetic properties. In the first part I will show how coordination chemistry can provide examples of molecular 2D magnets that, in contrast to what happens with the inorganic 2D magnets, are chemically stable in open air, keeping their magnetic properties preserved upon functionalizing their surface with different organic molecules.1 In the second part I propose to create hybrid heterostructures by interfacing a layer of a functional molecular material with a 2D material. The aim is that of tuning the properties of the "all surface" 2D material via an active control of the hybrid interface.[2] To reach this goal the molecular system of choice will be based on spin-crossover complexes able to switch between the two spin states upon the application of an external stimulus (temperature, light or pressure). This concept will provide an entire new class of stimuli-responsive molecular/2D heterostructures, which may be at the origin of a novel generation of hybrid materials and devices of direct application in highly topical fields like electronics, spintronics and molecular sensing.

References
1. J. Lopez-Cabrelles et al. Nature Chem. 2018, 10, 1001
2. J. Dugay et al. Nano Lett. 2017, 17, 186