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Structural and chemical versatility in two-dimensional coordination polymers

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Chemical functionalization of two-dimensional materials is an important approach to tune their stability or functionalities. [1] Current post-synthetic methodologies typically result in defective materials with no control of the position of the functional molecules. Two-dimensional hybrid organic-inorganic polymers are an emerging group of materials analogues of graphene [2], whose molecular composition allows, by chemical design, a surface tunability and the presence of various functionalities.

Here we present a new family of this type of hybrids materials based in magnetic Fe(II) centres, denoted MUV-1-X (MUV = Materials of the University of Valencia, X = H, Cl, Br, CH3, NH2), [3] which can be easily exfoliated mechanically down to the monolayer retaining the magnetic properties. The molecular nature of these crystalline solids based on coordination chemistry allows a presynthetic functionalization, yielding an homogeneous functionalized surface, and permits to tailor the physical properties of the layers, exemplified with the tuning of the wettability. Finally, the high robustnetss and chemical stability of the exfolitated monolayers has enabled us to study the mechanical properties of these molecularly-thin layers.

References

[1] S. Lei, et al. Nat. Nanotechnol, 11 (2016) 465
[2] D. Rodríguez-San-Miguel, et al., Chem. Comm., 52 (2016) 4113
[3] J. López-Cabrelles, S. Mañas-Valero et al., Nature Chemistry, 10 (2018) 1001

Figures

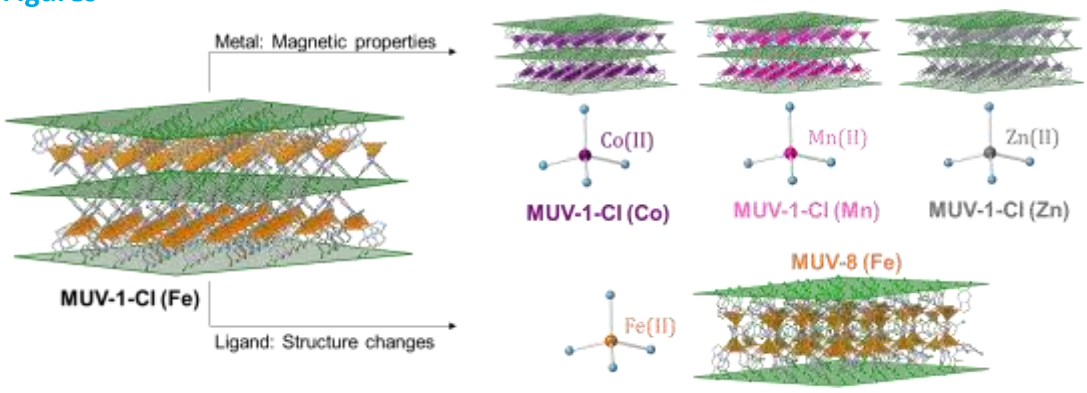

Figure 1: Broad versatility of the MUV-1-Cl system; is possible modify the magnetic properties of the material changing the metallic cation (upper part), and modifying the ligand adding a second substituent, is possible to induce structural changes keeping the layered morphology and the possibility to reach a two-dimensional material.)