Tailoring electronic and magnetic properties with molecular strategies: from ligand chemistry to covalent nanoarchitectures.

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The flexibility of synthetic chemistry can be exploited in various ways for tailoring electronic and magnetic properties of nanomaterials. One can use ligand chemistry to tune the properties of single magnetic ions and their interaction with the underlying surface. This interaction can be finely tuned by weak intermolecular interactions in self-assembled structures. A different strategy aims at using coordinate or covalent bonding to build nanoarchitectures out of molecular building blocks. Here the stronger coupling leads to the emergence of properties that are not related with those of the building blocks, such as highly delocalized bands or magnetic exchange.
Here I will present different strategies studied in our group to: i) tune interactions between magnetic molecules and metallic [1] and topological insulator surfaces [2], ii) combine Dirac and flat bands in a single metal-organic framework [3], and iii) build graphene-based nanoarchitectures with atomic precision [4].

References

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Figures

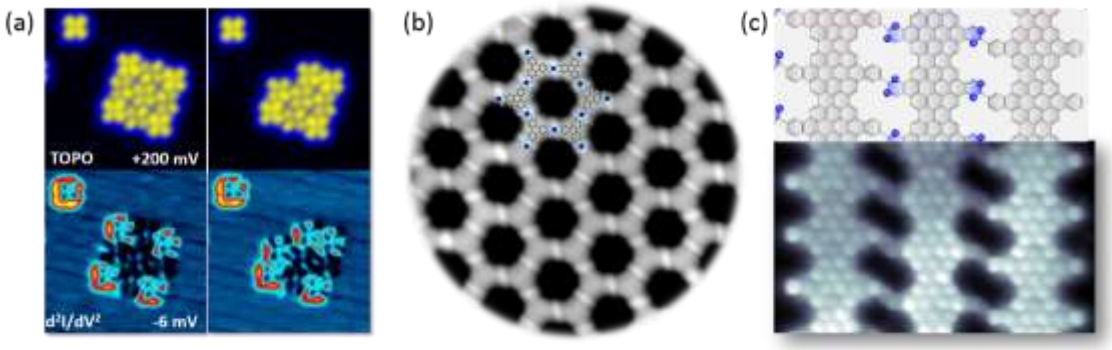

Figure 1. (a) STM topographic and spectroscopic maps of a self-assembled cluster of CuPc molecules, before and after removal of one corner molecule, demonstrating how weak intermolecular interactions can dramatically affect the electronic and magnetic properties of neighbor molecules. (b) Example of an on-surface synthesized metal-organic framework with honeycomb structure, where Dirac and flat bands coexist. (c) Example of an on-surface synthesized, graphene-based lateral superlattice heterostructure.