Organic molecular materials in one and two dimensions

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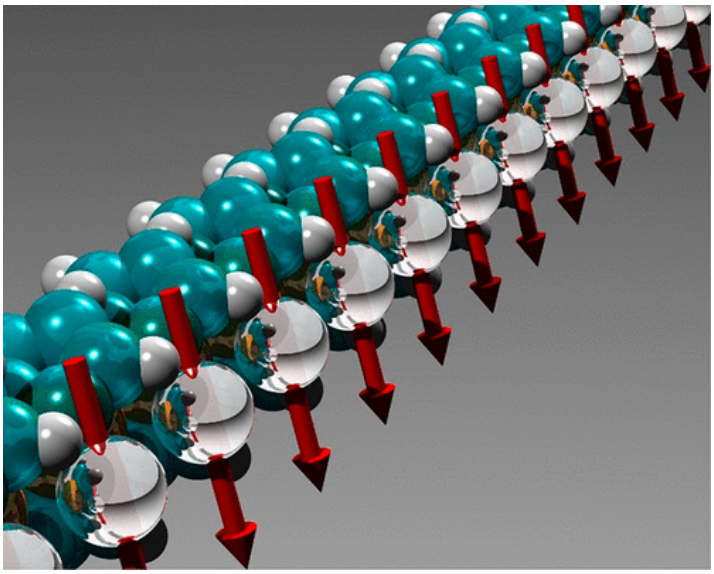
Bottom-up approaches hold the promise of targeted design of nanomaterials. Using suitably-chosen organic molecular building blocks, we can target the structure and function of the product materials.[1] Constructing these materials on a surface provides further control of the structure: the surface enforces planarity, provides an epitaxial template, and can also modify the deposited molecules by acting as a catalyst or by donating adatoms. The variety of available molecular building blocks and surfaces provides access to a near-infinite range of 1D and 2D structures.

Here, I will discuss our recent work in using small molecule precursors to synthesize nanomaterials through on-surface reactions. Using surface-catalysed reactions, we have investigated the on-surface coupling of a range of small aromatic molecules on transition metal surfaces. We use key surface science techniques (photoelectron spectroscopy, inverse photoelectron spectroscopy, scanning tunneling microscopy, density functional theory) to performed detailed investigations of the reaction process and products, providing insight into the formation of these architectures, and demonstrating some of the novel characteristics of the materials formed through these processes, such as the half-metallicity of the 1D polyferrocene shown schematically at right.[2]



[1] J MacLeod, *J. Phys. D Appl. Phys.*. **53(4)**, 043002 (2019).

[2] L Atkinson, V Jayalatharachchi, T Liao, J Lipton-Duffin and J MacLeod, *J. Phys. Chem. C,* **126(27),** 11341 (2022).