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Soluble Two-Dimensional Covalent Organometallic Polymers by(Arene)Ruthenium-Sulfur Chemistry

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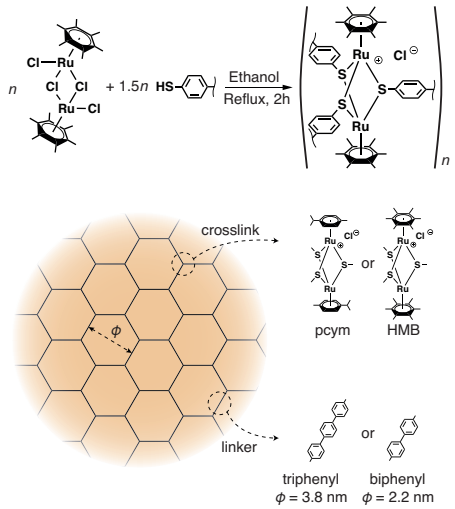
Conjugated two-dimensional (2D) materials are ultimately thin species, in which the hoping of charge carriers between neighboring atomic sites governs conduction. Graphene, which may be regarded as a giant conjugated molecule, is a typical example. Rich electronic, magnetic, and optical properties are expected in 2D materials with more complex structure and composition than graphene.

Here, a new class of two-dimensional (2D) covalent organometallic polymers, with nanometer-scale crosslinking, is obtained by arene(ruthenium) sulfur chemistry. Their ambivalent nature, with positively charged crosslinks and lypophylic branches, is the key to the often sought-for and usually hard-to-achieve solubility of 2D polymers in various kinds of solvents. Solubility is here controlled by the planarity of the polymer, which in turn controls Coulomb interactions between the polymer layers. High planarity is achieved for high symmetry crosslinks and short, rigid branches. Owing to their solubility, the polymers are straightforwardly processable, and can be handled as powders, deposited on surfaces by mere spin-coating, or suspended across membranes by drop-casting.[1] The novel 2D materials are potential candidates as flexible membranes for catalysis, cancer therapy, and electronics.



Schematic Representation of the Formation of Sulfur-Linked 2D Covalent (Arene)Ruthenium Polymers from $[\eta^6\text{-(pcym)RuCl}_2]_2$, $[\eta^6\text{-(HMB)RuCl}_2]_2$, Dithiophenol-Oligo-p-Diphenylene, and Dithiophenol-Oligo-p-Terphenylene.

[1] F. Cherioux, J. Coraux, V. L. Muller, L. Magaud, N. Bendiab, M. den Hertog, O. Leynaud, W. Hourani, S. Lamare, D. Kamaruddin, F. Palmino, R. Salut, *Chem. Eur. J.* **2017**, 10.1002/chem.201700054.