Rings, Chains and Polymers

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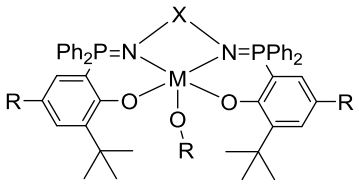
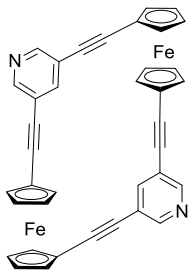
Nicholas Long is the Sir Edward Frankland BP Professor of Inorganic Chemistry (endowed chair) at Imperial College London. He possesses wide-ranging experience and expertise in synthetic inorganic and organometallic chemistry and his novel compounds have found applications within catalysis, materials science and biomedical imaging. He has published 191 scientific papers (h-index 45) and several patents, won the 2006 Royal Society of Chemistry Prize for Organometallic Chemistry, was a Leverhulme Trust Research Fellow in 2010 and gained a prestigious Royal Society Wolfson Research Merit Award in 2018. He is currently Deputy-Director of the new King's/Imperial EPSRC Centre for Doctoral Training in Medical Imaging (www.imagingcdt.com) and will be on the UK REF Assessment Panel (2020/21).

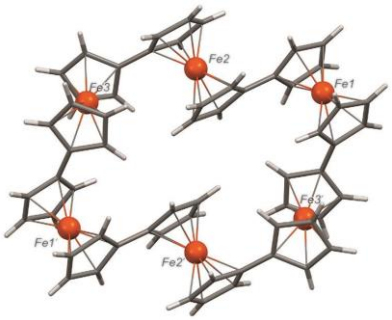
Catalytic chemistry has many roles, and it is difficult to imagine a society without its use in the formation of a myriad of chemicals, polymers, and pharmaceuticals, most of which are prepared industrially. In biology, there is enzyme catalysis, a form of homogeneous catalysis that controls the rates of virtually all reactions occurring in living systems. This presentation details the use of d- and f-block elements in catalytic processes leading to the formation of a range of functional materials.

Polymers - within lactide polymerization, one of the greatest challenges is to engineer polymer tacticity control via the metal catalyst. Using new versatile ligand frameworks that allow functionalisation and derivation, families of metal pro-catalysts are being developed from which meaningful trends and data can be elucidated. We have demonstrated [1] that yttrium and lanthanum phosphasalen initiators are highly active for stereocontrolled ring-opening polymerization, and they enable access to high iso-selectivities or hetero-selectivities. The initiators also show very high rates, excellent polymerisation control, and tolerance to low loadings. The combination of such high rates with high iso-selectivities is unusual.



Rings and Chains - the capability of single molecules as mediators of electron transfer has led to their development as analogues of known solid-state electronic components such as wires, switches or diodes. In recent years however, it has become widely recognized that molecules can exhibit functionality beyond that of existing macrocyclic circuitry. To understand this and so allow development of the field, the study of unique molecular structures is essential. To this end, we are pursuing the synthesis and characterization of various new, fixed-shape, redox-active macrocycles (and other branched materials) [2, 3] some of which feature surface-binding groups to allow a 'wiring up' between electrodes. The crucial role of metal (copper, palladium)-mediated processes in the synthesis of these ferrocene-containing macrocycles and chains will be discussed, alongside an investigation of their redox-activity.





1. C. Bakewell, A. J. P. White, N. J. Long, C. K Williams, *Angew. Chem. Int. Ed*., **2014**, *53*, 9226.
2. L. E. Wilson, C. Hassenrueck, R. F. Winter, A. J. P. White, T. Albrecht, N. J. Long, *Angew. Chem. Int. Ed*., **2017**, *56*, 6838.
3. M. S. Inkpen, S. Scheerer, M. Linseis, A. J. P. White, R. Winter, T. Albrecht, N. J. Long, *Nature Chem*., **2016**, *8*, 825.