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Polyoxometalate and Chalcoxide Molecular Systems: From Self-Assembly to Functionality

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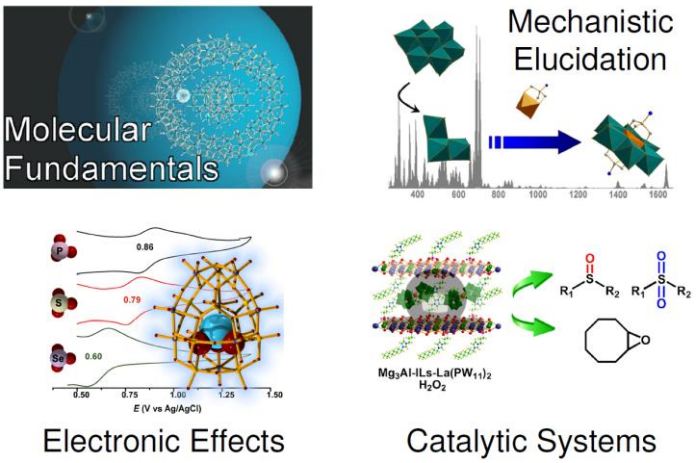
Abstract

Molecular self-assembly is an exciting occurrence which governs how simple building blocks can be organized spontaneously into complex architectures. Such self-assembly processes are highly dependent upon the experimental conditions often to such a degree that total control is never easily achieved. More specifically, polyoxometalate and recently chalcoxide clusters represent an unparalleled range of architectures and chemical properties, frequently acting as a set of transferable building blocks that can be reliably utilized in the formation of new materials. The chemistry of self-assembled inorganic systems in general, is an important emerging area that promises to allow the development of sophisticated molecule-based materials and devices with numerous applications ranging from electronics and catalysis to physics. Thus, the deeper understanding of the underlying fundamental chemistry is of vital importance in our effort to gain real control and introduce the element of design in inorganic materials synthesis. The purpose of this paper is to provide an overview of our efforts to unveil the main underlying processes that have been recently discovered by our group and are based on spontaneous formation of information-rich, autocatalytic sets of replicating inorganic molecules that work via molecular recognition. The exploitation of these phenomena will allow the targeted generation of information-rich inorganic systems which will give rise to complex functionality usually observed only in biological systems.



Recent Publications

1. Miras H. N., Yan J., Long D.-L., Cronin L., *Chem. Soc. Rev.* 41 (2012), 7403–7430.
2. Zang H.-Y., Chen J.-J., Long D.-L., Cronin L., Miras H. N., *Adv. Mater.* 25 (2013), 6245–6249.
3. Zang H.-Y., Chen J.-J., Long D.-L., Cronin L., Miras H. N., *Chem. Sci.* 7 (2016), 3798-3804.
4. Sartzi H., Long D.-L., Sproules S., Cronin L., Miras H. N., *Chem. Eur. J.* 24 (2018), 4399 – 4411.
5. McAllister J., Bandeira N. A.G., McGlynn J. C., Ganin, A. Y., Song, Y.-F., Bo C., Miras, H. N., *Nature Commun.* 10 (2019), 370.

Biography

H. N. Miras is Senior Lecturer (Associate Professor) at the School of Chemistry, University of Glasgow, UK where he established his independent research group in 2013. He is expert in synthetic chemistry, Electrospray Ionisation Mass Spectrometry (ESI-MS), mechanistic studies of nano-sized clusters and design of molecule based functional systems. His interests are focused on the development of metal oxide/chalcogenide molecule based materials for energy applications as well as the understanding of fundamental processes in the self-assembly of supramolecular clusters and molecular nanomaterials. In 2010 he has been awarded a 5-year personal research fellowship by the Royal Society of Edinburgh while in 2012 he was finalist in the European Young Chemist Award competition. In 2013 he was awarded a Leadership Fellow Award and a Lectureship by the University of Glasgow. To date he published more than 110 papers, >3500 citations and an *h*-index of 33.

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