

## An introduction to the virtual issue on *Coordination polymers*

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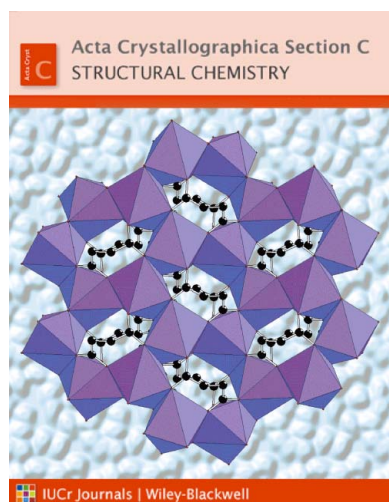
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The past two decades have witnessed a veritable explosion of reports detailing the solid-state structures of coordination compounds consisting of conceptually infinite one-dimensional chains, two-dimensional nets and three-dimensional frameworks. The obvious common feature shared by these different types of compounds is that they all consist of metal-containing nodes that are ‘infinitely’ bridged by *exo*-multidentate ligands. Unfortunately there has been little consistency in the literature with regard to the terminology used to describe such materials and it is therefore essential to preface any credible discussion of extended coordination entities with a comment on nomenclature. In this regard, the reader is encouraged to consult the final report of the IUPAC task group on ‘*Coordination Polymers and Metal Organic Frameworks: Terminology and Nomenclature Guidelines*’ (Batten *et al.*, 2013). In accordance with the task group’s recommendations, the author of this editorial regards all structures comprised of coordination entities extending in one, two or three dimensions to be coordination polymers. Structures that extend in two or three dimensions can further be classified as coordination networks, while those that contain potential voids can additionally be referred to as metal–organic frameworks.

Taken at face value, the concepts involved are relatively simple; crystalline coordination polymers are most often formed from solutions containing metal ions and bridging ligands. Nodes derived from the metal ions may become linked in various possible ways that adhere to the symmetries and periodicities normally inherent to crystal packing. The rich diversity of architectures arising from these relatively simple preparations is due to the many factors that can influence metal–ligand connectivity. Since many of these factors can be controlled relatively easily, the field of coordination polymer research is still wide open for significant further exploration. Moreover, the ever-increasing popularity of the field is also strongly linked to the widespread availability of modern X-ray diffractometers and advanced crystal structure solution/refinement software packages that enable even relatively inexperienced crystallographers to carry out routine analyses.

The seemingly unlimited opportunities for preparing novel coordination polymers arise not only from obvious choices that influence structural topology (*i.e.* bridging ligand geometry and metal ion coordination mode) but also from a range of other factors, some of which can be quite subtle. These include (but are not limited to): counter-ions, solvent systems, mixtures of ligands and/or metal ions, ligand flexibility, proclivity for metal cluster formation, interpenetration and crystallization conditions. In the overriding majority of cases it is still not possible to construct desired framework topologies at will simply by judicious choice of the various factors at play. However, it is widely acknowledged that the control of internal architecture is one of the ‘holy grails’ of the vast field of crystal engineering owing to the promise that rational design strategies hold for new and potentially useful materials. Indeed, metal–organic frameworks, a distinct subclass of three-dimensional coordination polymers, have been widely studied in the context of their porous features with a view to rivalling the useful properties of zeolites for gas storage and separation as well as catalysis. Other desirable properties that may ultimately result from bottom-up materials design include magnetism, luminescence, fluorescence and anomalous thermal expansion.

In order to gain significant insight into the self-assembly of a judiciously selected set of components, it is important to first amass a large collection of crystal structures. It is hoped that the knowledge thus gained can then be applied



retrospectively to the design and assembly of exciting new materials. It would be a colossal undertaking to summarize the vast number of polymeric coordination complexes that have been reported over the past two decades, but the collection of articles selected for this virtual issue ([http://journals.iucr.org/special\\_issues/2014/coordinationpolymers](http://journals.iucr.org/special_issues/2014/coordinationpolymers)) of *Acta Crystallographica Section C* (one-dimensional, 58 articles; two-dimensional, 26

articles; three-dimensional, 22 articles) serves to showcase the amazing diversity of the field.

#### References

- Batten, S. R., Champness, N. R., Chen, X.-M., Garcia-Martinez, J., Kitagawa, S., Öhrström, L., O’Keeffe, M., Suh, M. P. & Reedijk, J. (2013). *Pure Appl. Chem.* **85**, 1715–1724.