

Complex systems of cages via subcomponent self-assembly

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The use of chemical self-assembly as a synthetic technique can simplify materials preparation by shifting intellectual effort away from designing molecules, and towards the design of *chemical systems* that are capable of self-assembling in such a way as to express desired properties and functions. Below are shown the subcomponent precursors and structures of three of products that can form functional constituents of these systems (Figure 1).

Current challenges involve inducing multiple structures to form in parallel,^[4] such that they may act in concert to achieve a catalytic goal.^[5] Our techniques thus provide a point of entry into the emerging field of *systems chemistry*.^[6] Functional systems that we have recently developed include a fuel-controlled self-assembly process^[7] and a series of cages that can phase-segregate^[8] and transit between liquid phases.^[9]

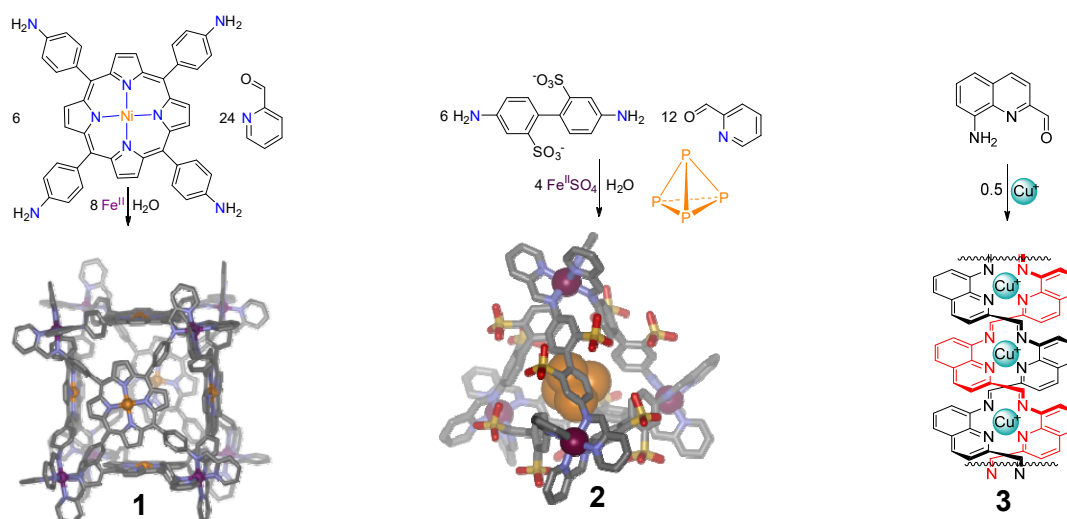


Figure 1. Fe^{II}8 cubic cage **1**,^[1] Fe^{II}4 tetrahedral cage **2**,^[2] and electroluminescent Cu^In double-helical polymer **3**^[3]

References

- [1] W. Meng, B. Breiner, K. Rissanen, J. D. Thoburn, J. K. Clegg, J. R. Nitschke, *Angew. Chem. Int. Ed.* 2011, 50, 3479-3483.
- [2] P. Mal, B. Breiner, K. Rissanen, J. R. Nitschke, *Science* 2009, 324, 1697-1699.
- [3] (a) J. L. Greenfield, F. J. Rizzuto, I. Goldberga, J. Nitschke, *Angew. Chem. Int. Ed.* 2017, 56, 7541-7545; (b) J. L. Greenfield, E. W. Evans, D. Di Nuzzo, M. Di Antonio, R. H. Friend, J. R. Nitschke, *J. Am. Chem. Soc.* 2018, 140, 10344-10353.
- [4] A. Jiménez, R. A. Bilbeisi, T. K. Ronson, S. Zarra, C. Woodhead, J. R. Nitschke, *Angew. Chem. Int. Ed.* 2014, 53, 4556-4560.
- [5] A. G. Salles, S. Zarra, R. M. Turner, J. R. Nitschke, *J. Am. Chem. Soc.* 2013, 135, 17052-17059.
- [6] J. R. Nitschke, *Nature* 2009, 462, 736-738.
- [7] C. S. Wood, C. Browne, D. M. Wood, J. R. Nitschke, *ACS Cent. Sci.* 2015, 1, 504-509.
- [8] A. B. Grommet, J. L. Bolliger, C. Browne, J. R. Nitschke, *Angew. Chem. Int. Ed.* 2015, 54, 15100-15104.
- [9] (a) A. B. Grommet, J. R. Nitschke, *J. Am. Chem. Soc.* 2017, 139, 2176-2179; (b) B. S. Pilgrim, D. A. Roberts, T. G. Lohr, T. K. Ronson, J. R. Nitschke, *Nature Chem.* 2017, 9, 1276.