

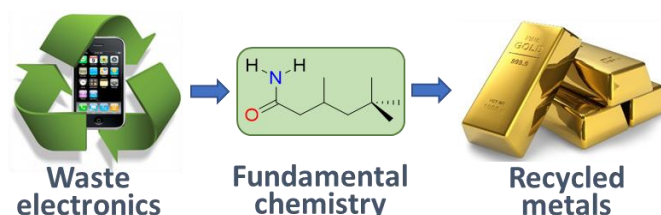
Sustainable Chemistry for Metal Recycling

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Metals are ubiquitous in modern technology and their recycling from sources such as electronic waste, magnets, and high-performance materials is crucial to achieve circular economy visions and to ensure that wastes are both minimised and environmentally benign.¹ In this presentation, the application and significance of coordination and supramolecular chemistry in metal recycling processes will be highlighted.² New routes to the dissolution and selective separation of gold and other metals from electronic waste will be described,³ along with the selective precipitation of light rare-earth and actinide elements using a unique supramolecular encapsulation strategy.⁴ These case studies rationalise the need to understand the mode of action in separations processes at a fundamental chemical level and the ability to exploit ligand design to achieve new and useful separations technologies.



References.

1. R. M. Izatt, S. R. Izatt, R. L. Bruening, N. E. Izatt, B. A. Moyer, "Challenges to achievement of metal sustainability in our high-tech society," *Chem. Soc. Rev.* **2014**, *43*, 2451-2475; M. D. Rao, K. K. Singh, C. A. Morrison, J. B. Love, **2020**, "Challenges and opportunities in the recovery of gold from electronic waste," *RSC Advances*, *10*, 4300-4309.
2. A. M. Wilson, P. J. Bailey, P. A. Tasker, J. R. Turkington, R. A. Grant, J. B. Love, "Solvent extraction: the coordination chemistry behind extractive metallurgy." *Chem. Soc. Rev.*, **2014**, *43*, 123-134
3. E. D. Doidge, I. Carson, P. A. Tasker, R. J. Ellis, C. A. Morrison, J. B. Love, "A simple primary amide for the selective recovery of gold from secondary resources," *Angew. Chem. Int. Ed.*, **2016**, *55*, 12436-12439; L. M. M. Kinsman, C. A. Morrison, B. T. Ngwenya, J. B. Love, "Tuneable separation of gold by selective precipitation using a simple and recyclable diamide," *Nat. Commun.*, **2021**, *12*, 6258; A. Nag, C. A. Morrison, J. B. Love, "Rapid dissolution of noble metals in organic solvents," *ChemSusChem*, **2022**, *15*, e202201285; A. Nag, M. K. Singh, C. A. Morrison, J. B. Love, "Efficient Recycling of Gold and Copper from Electronic Waste by Selective Precipitation," *Angew. Chem. Int. Ed.*, **2023**, DOI:10.1002/anie.202308356.
4. J. G. O'Connell-Danes, B. T. Ngwenya, C. A. Morrison, J. B. Love, *Nat. Commun.*, "Selective separation of light rare-earth elements by supramolecular encapsulation and precipitation," **2023**, *13*, 4497; J. G. O'Connell-Danes, B. T. Ngwenya, C. A. Morrison, G. S. Nichol, L. H. Delmau, J. B. Love, "Shape-selective supramolecular capsules for actinide precipitation and separation," **2023**, *under review*.