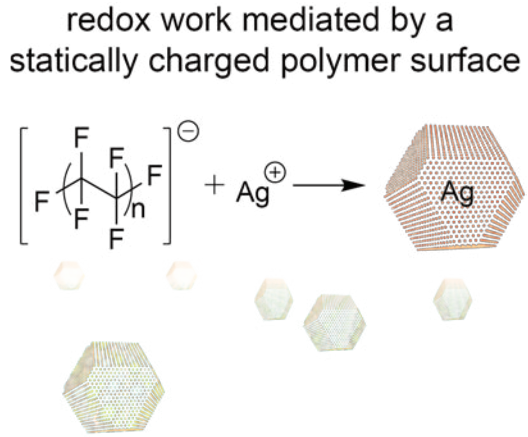
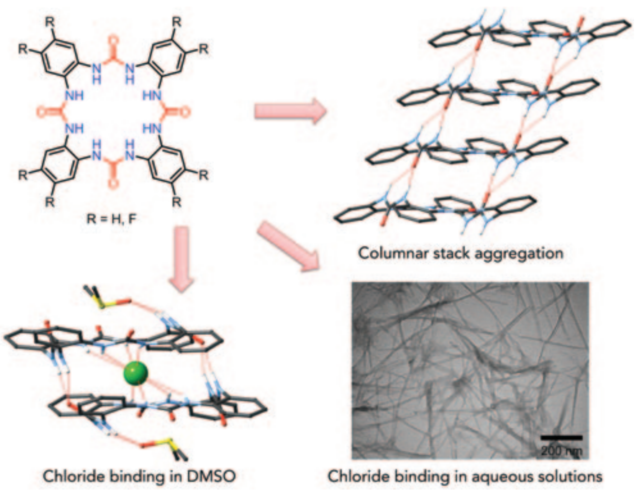


Getting a grip on static electricity

Electrically insulating objects gain a net electrical charge when brought into and out of contact. This phenomenon – triboelectricity – involves the flow of charged species, but to conclusively establish their nature has proven extremely difficult. A team of researchers from Curtin University, the Australian National University and the University of New South Wales has studied the redox growth of metal nanoparticles on electrostatically charged polymers and, by means of a Faraday pail, XPS, AFM, TEM and quantum chemistry, they have described, for the first time, a material-specific relationship between the tribocharging magnitude and the extent of redox work that can be harvested from tribocharged polymers (Zhang J., Rogers F.J.M., Darwish N., Gonçales V.R., Vogel Y.B., Wang F., Gooding J.J., Peiris M.C.R., Jia G., Veder J.-P., Coote M.L., Ciampi S. *J. Am. Chem. Soc.* 2019, **141**, 5863–70). Interestingly, the amount of work done by an electrified dielectric was shown to exceed the Coulomb reading in the electrometer/ Faraday pail, demonstrating that the charged surface is a mosaic of positive and negative charges. By extending chemical understanding of static electricity, this work paves the way for the design of plastic materials for which electrification upon contact – deliberate or not – can be either maximised or prevented.

Self-assembled selective anion receptor

The development of selective anion receptors continues to be an important focus of supramolecular chemistry research due to the many roles anions play in industrial processes, as pollutants in the environment, and as electrolytes in biological systems. Surprisingly, until recently there were no examples of neutral anion receptors that are capable of selective chloride complexation in >50% aqueous solutions. Now, a team headed by Phil Gale at the University of Sydney, together with co-workers at UNSW, has discovered a simple symmetrical tetraurea macrocycle that assembles into aggregates and binds chloride ions selectively in aqueous solutions (Wu X., Wang P., Turner P., Lewis W., Catal O., Thomas D.S., Gale P.A. *Chem* 2019, **5**, 1210–22). The macrocycle has a strong tendency to self-associate into columnar aggregates via intermolecular hydrogen bonds and aromatic stacking. In aqueous solutions, macrocycle aggregation generates solvent-shielding and size-selective binding pockets favourable for hydrogen bonding with chloride. As a result, micromolar affinity and highly selective chloride binding were achieved with this simple small molecule in 60 vol% water/acetonitrile. This macrocycle opens a new path for achieving selective anion binding under highly competitive aqueous conditions within an aggregated receptor.



A drop of acid to power an aqueous battery

The aqueous battery is particularly advantageous for practical large-scale and sustainable electric energy storage because of its relatively low cost and high safety. However, grid-scale applications are severely limited because of the low output voltage and energy density compared with more conventional lithium-ion batteries. Now, a team led by Shi-Zhang Qiao of the University of Adelaide has developed a new low-cost high-voltage electrolytic Zn–MnO_2 battery by adding an extra drop of acid to a traditional zinc-ion battery, in which electrodeposition/electrolysis of a Zn anode and MnO_2 cathode couple is employed (Chao D., Zhou W., Ye C., Zhang Q., Chen Y., Gu L., Davey K., Qiao S. *Angew. Chem. Int. Ed.* 2019, **58**, 7823–8). This new electrolytic battery has an impressive flat-discharge plateau of 1.95 V and long-term rate durability of 1800 cycles, together with a record energy density of ~409 Wh kg^{-1}. The cost is conservatively estimated at under US$10/kWh. These results will advance the development of zinc-based batteries for practical energy storage and grid-scale application. This work may also benefit Australia's battery industry and significantly expand applications of Australia's zinc and manganese resources.