

Report of 15 September 2016 Meeting

Royal Society

Southern Highlands Branch

Speaker: Professor Anthony Masters, Chair of the University of Sydney
Academic Board and Fellow of the University Senate

Topic: Sustainability: Chemical solutions for tricky problems

“If we are unable to hand over to our children and their children, the means to at least as good a lifestyle as that we now enjoy, we have failed miserably as a civilization. This challenge become more acute as we approach the resource and energy limits of our planet. To even approach a “sustainable” existence, such that the ecosphere exists in a “steady state” able to support our current lifestyle, a 4 to 10-fold increase in the resource efficiency of existing production processes will be necessary.”

These words by Tony Masters aptly describe the philosophy behind his team’s research at Sydney University. In this lecture, Tony spoke to the 42 person audience of two major research projects currently being undertaken. The first is examining the catalytic generation of fuels and specialty chemicals from renewable resources such as biomass, water and the sun. The second concerns novel battery technologies for improved energy storage. In all of this research, the emphasis is on using earth-abundant materials as catalysts; wastes, non-potable water and other sustainable and renewal resources provide feedstocks for green chemistry processes.

These research projects have been so successful that already the team has spun out two companies, Gelion and Licella. At Gelion, the company is developing batteries made with nano-structured gels which claim better performance than lithium ion batteries in their charging and discharging speed, as well as being smaller, safer, more durable and cheaper. These gel flexible batteries have the potential to be 3-D printable and offer the possibility of being incorporated into the walls of buildings because of their “bendy” characteristics. They differ from zinc-bromine flow batteries in that they use a gel instead of a liquid.

According to Gelion, the charge time for the battery has come down to just a few minutes, while its efficiency is at 90%, which is higher than in our mobile phones. Its increased safety over lithium batteries comes from the fact that the gel is made of fire-retardant material. Although the nano-structured gel allows the batteries to be used in smaller appliances such as cars, computers and mobile phones, the initial target market for Gelion’s batteries is for energy storage in buildings, both residential and commercial. The “bendy” nature of the batteries has caught the attention of the building industry, including big name players such as Lend Lease. They see a future where flat-pack zinc-bromine batteries could be included into the very fabric of buildings, such as in prefabricated wall segments for example.

Tony Masters is a Fellow of the Royal Australian Chemical Institute. His research has produced over 150 papers and patents, over 50 conference presentations and gained over \$8 million in research support. Collaborations have involved researchers from the Universities of Sydney, Melbourne, Monash, Murdoch, Southampton, Liverpool, Witwatersrand, Venice, Cardiff, James Cook, Ben-Gurion and Cambridge. Other collaborations have involved researchers from CSIRO, DSIR New Zealand, The Royal Institution UK, TU Delft NL, and the Sydney College of the Arts. As for collaborations with industry, researchers involved have come from DSM Netherlands, Alpha Chemicals, Australian Biodiesel, Redflow, ZBB, Licella and Ignite Energy.

Most recently, successful ARC Linkage Grants with Professors Maschmeyer, Vassallo and Perrier have funded collaborations with local and international companies to develop improved biomass-derived polymers and novel high density zinc storage batteries.

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