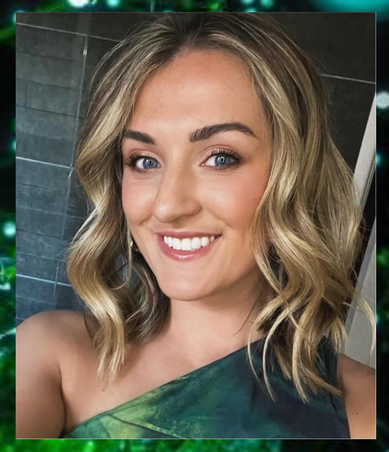
QUEEN'S UNIVERSITY BELFAST

QUEEN'S UNIVERSITY IONIC LIQUID LABORATORIES

QUILL



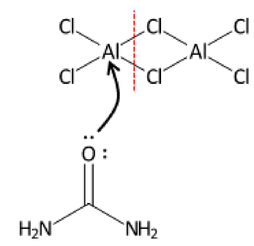
Aluminium liquid coordination complexes (LCCs) as electrolytes for aluminium batteries

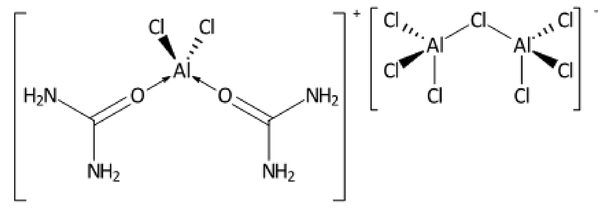
Beth Murray, Zak Quattorchi, Cuong Nguyen, Douglas R. MacFarlane, Karolina Matuszek, Małgorzata Swadźba-Kwaśny and Binayak Roy

Alternative to Li-ion batteries: Aluminium batteries

Inexpensive	•Al is the most abundant element in Earth's crust
High volumetric capacity	•Three electrons per cation in Al^{3+}
Challenge: cycling stability	•To date, only chloride-rich coordination around Al was found to support stable cycling

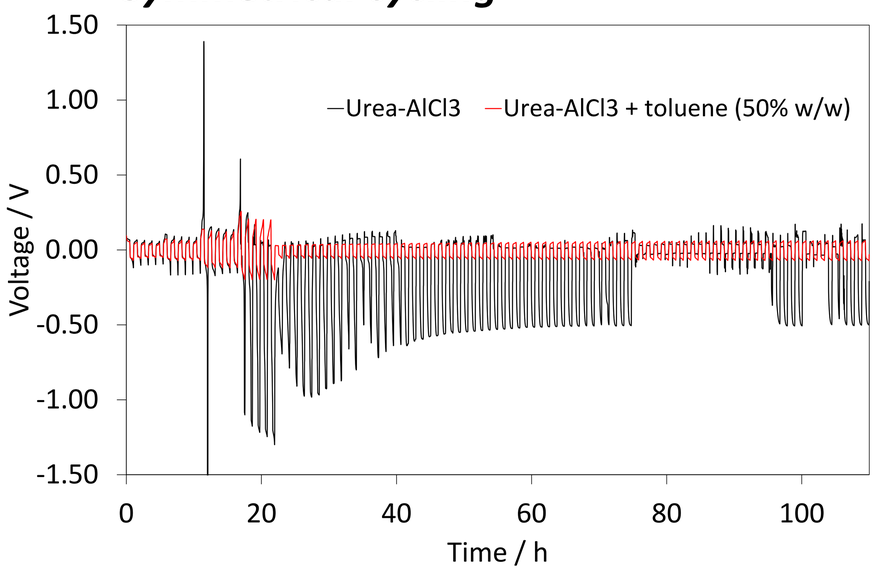
LCC: urea-$AlCl_3$



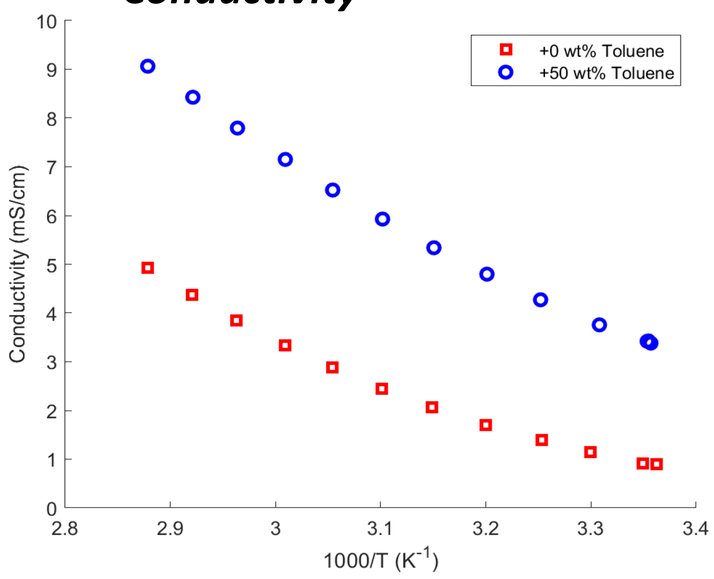


Doping LCC with toluene

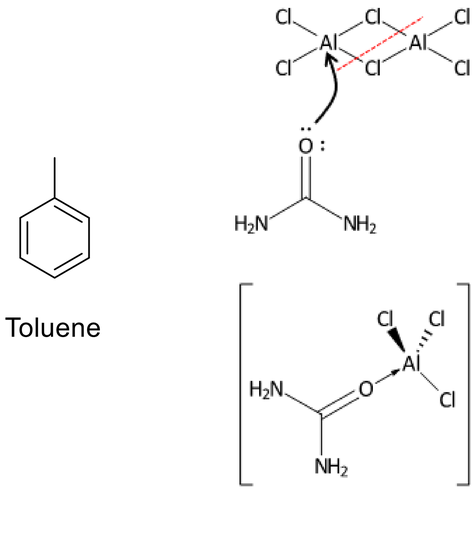
Symmetrical cycling



Conductivity

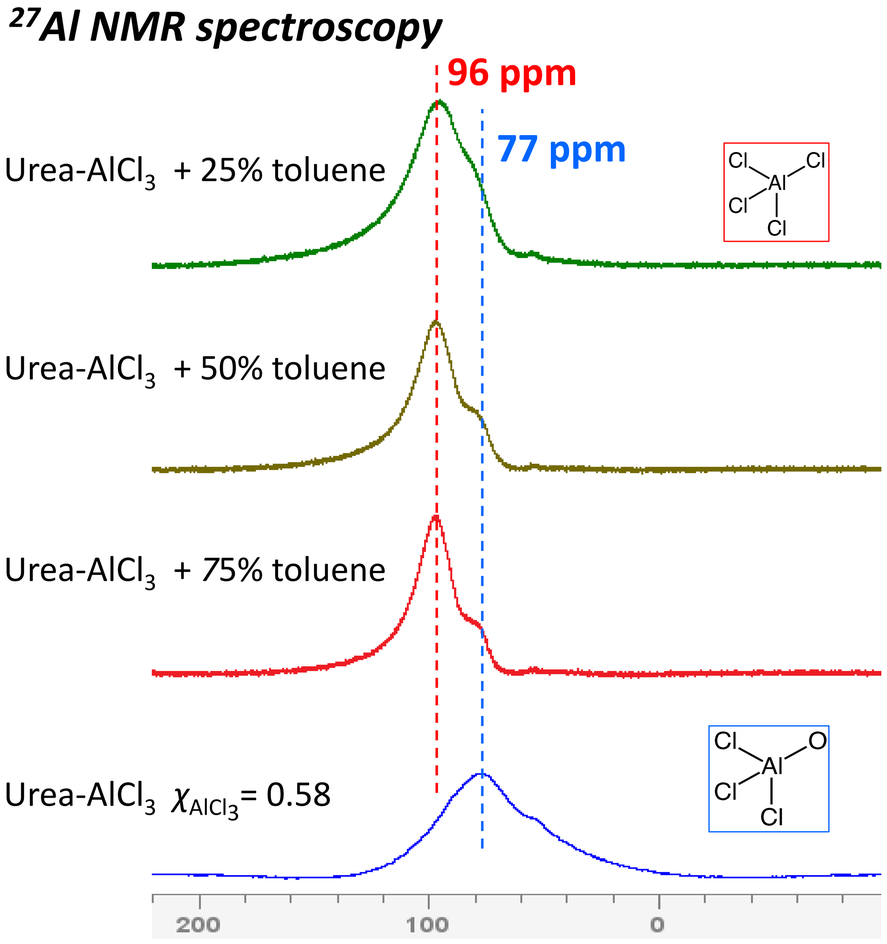


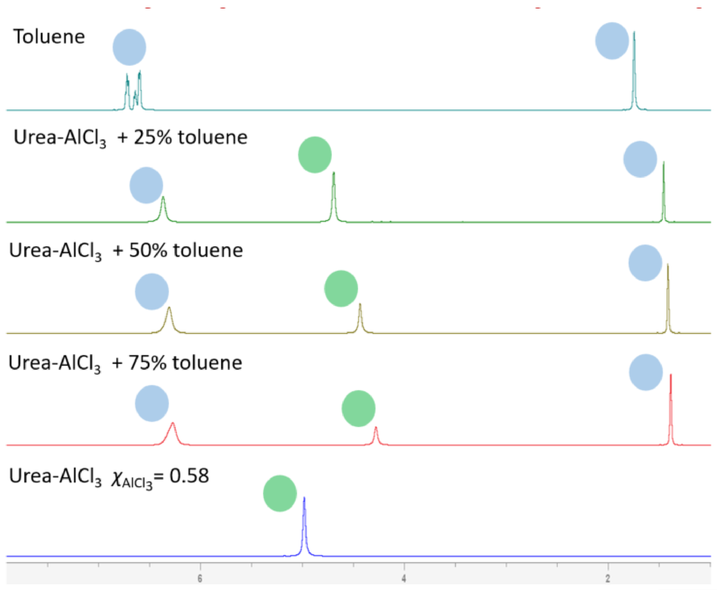
Toluene



Speciation studies

^{27}Al NMR spectroscopy





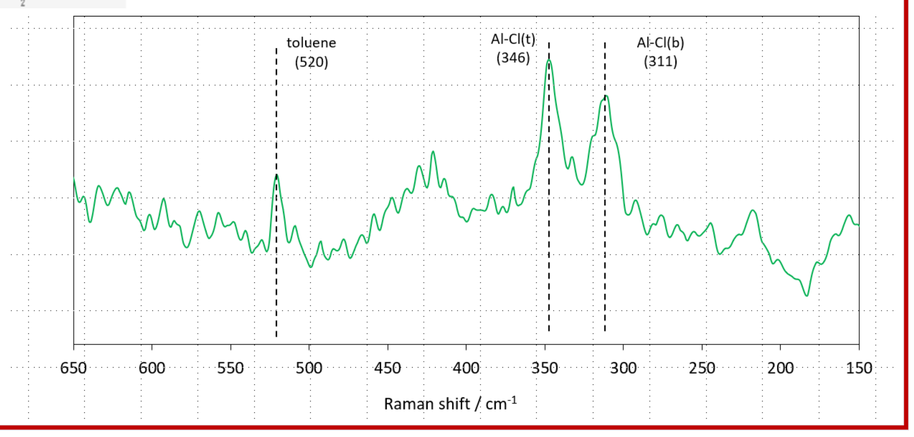
^{1}H NMR spectroscopy

- - Toluene peak
- - LCC peak

- No organic reaction occurred
- Significant shift in signals:
  - Toluene more shielded
  - Urea also more shielded

Raman spectroscopy

- Toluene peak – 520 remains when mixed with LCC
- Al-Cl (terminal and bridging) peaks from LCC present when mixed with toluene



References

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