Centre for **Sustainable & Circular** Technologies

MONASH University

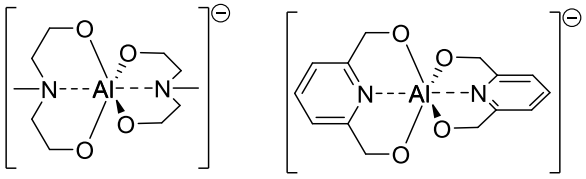
UNIVERSITY OF BATH

Bath Monash Global PhD Programme in Sustainable & Circular Technologies

Project Title:	Ionic liquids based on earth-abundant aluminium
Supervisors at Bath: Supervisors at Monash:	David Liptrot, Karen Edler Drasko Vidovic (lead)
Home Institution:	Monash
Indicative period at Host Institution:	18 months

Project Summary

Ionic liquids have been used, among other things, as green solvents, electrolytes, lubricants and liquid crystals due to their unique properties such as high thermal stability, low vapor pressure, high electric conductivity, etc. The nature of the cation (e.g. ammonium, phosphenium, imidazolium, etc.) has a strong influence on the properties of the ionic liquids and will usually define the stability. Nevertheless, the nature of the anion usually controls the chemistry and functionality of these materials and because they normally contain halides (e.g. PF_6^-, BF_4^-, $AlCl_4^-$, $SnCl_3^-$, $CuCl_3^-$ etc.) they are responsible for enticing unwanted corrosion. Thus, the main goal of this proposal is to prepare a range of ionic liquids in which the anionic part will be made of six-coordinate aluminium complexes that should offer a greater stability in comparison to the currently known anions. Our target is to use ligands based on N-methyldiethanolamine and 2,6-pyridinedimethanol as they would allow us to create six-coordinate aluminium-based anions as depicted in below.



Whilst characterisation of the physical properties imparted to ionic liquids by these structures will follow standard techniques, scattering methods will be used to give exquisite insight into structural components of the co-ordination sphere around aluminium as well as on larger scales, providing opportunities to develop new structure/activity relationships regarding ionic liquids. Further work will then explore the exploitation of aluminium-based anions as catalytically competent species whilst in the form of ionic liquids providing a new paradigm in green solvation and bond activation.

Features of the programme

- PhD researchers will be registered at both institutions and will be awarded a joint PhD degree.
- PhD researchers will be jointly supervised by academics from both Monash and Bath Universities.
- All PhD researchers in the joint programme will also undertake a bespoke advanced training plan covering a range of topics focusing on sustainability.
- Applicants can apply to either Monash University or the University of Bath as their nominated home institution.
- PhD researchers will undertake a period of no less than 12 months at the partner institution.
- Up to four scholarships/studentships will be offered. Additional and suitably qualified applicants who can access a scholarship/studentship from other sources will be also considered. Evidence of funding must be provided.
- The scholarships/studentships include:
  - a *full tuition fee sponsorship* provided by Monash or Bath for the course duration (up to a maximum 42 months). Note, however, that studentships for Bath-based projects will provide cover for UK/EU tuition fees ONLY.
  - *a living allowance (stipend)* provided by Monash or Bath Universities.

Note: Overseas Student Health Cover (OSHC) must be paid by the student, unless covered by the university.

How to apply

You MUST express interest for three projects in order of preference. Please submit your application at the Home institution of your preferred project ('Home' institution details can be found in the project summary). However, please note that you are applying for a joint PhD programme and applications will be processed as such.

The deadline to submit applications is 11th April 2021

Monash University

Expressions of interest (EoI) can be lodged through https://www.monash.edu/science/bath-monash-program. The EoI should provide the following information:

CV including details of citizenship, your Official Academic Transcripts, key to grades/grading scale of your transcripts, evidence of English language proficiency (IELTS or TOEFL, for full requirements see: https://www.monash.edu/graduate-research/faqs-and-resources/content/chapter-two/2-2), and two referees and contact details (optional). You must provide a link to these documents in Section 8 using Google Drive (Instructions in Section 8).

University of Bath

Please submit your application through the following link: https://www.csct.ac.uk/bath-monash-global-phd-programme/

Please make sure to mention in the "finance" section of your application that you are applying for funding through the joint Bath/Monash PhD programme for your specified projects.

In the "research interests" section of your application, please name the three projects you are interested in and rank them in order of preference. Please also include the names of the Bath lead supervisors.