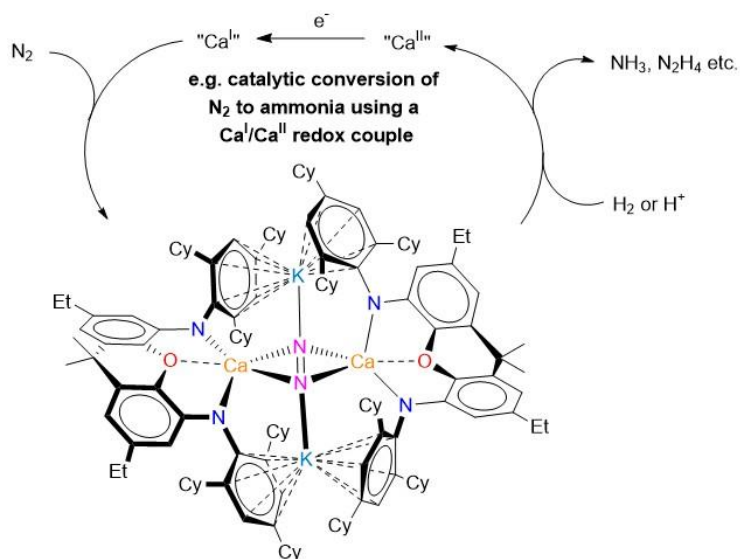


Bath Monash Global PhD Programme in Sustainable & Circular Technologies

Project Title:	Selective Alkaline Earth-centred Activation of Inert Bonds and Substrates
Supervisors at Bath:	Prof. Michael S. Hill
Supervisors at Monash:	Prof. Cameron Jones FAA
Home Institution:	Monash
Indicative period at Host Institution	Year 3 of 3.5 years

Project Summary (to include a brief description of the relevance to sustainable & circular technologies)

Although the activation and reduction of commodity small molecules underpins many of the chemical transformations vital for the maintenance of human society, a majority of large-scale processes continue to be based around the use of precious metals of the heavier d-block (e.g. Pd, Pt, Ir). The development of new reagents and catalysts derived from more earth-abundant metals and non-toxic metals has, thus, been recognized as a vital undertaking. The ecologically benign and inexpensive alkaline elements of groups 1 and 2 fulfil many of these requirements, and the Jones (Monash) and Hill (Bath) groups are among the pioneers in catalysis, and the catalytically relevant activation of small molecule substrates, using normal and low oxidation state reagents derived from alkaline earth metals (e.g. magnesium, calcium).^{1,2} Both groups have previously reported a variety of transformations leading to the productive activation of the thermodynamically robust bonds of the industrially relevant small molecules H_2 ,³ benzene,⁴ and CO .⁵ Although more recent advances have shown that the even more challenging $N\equiv N$ triple bond yields to reduction by putative $Ca(I)$ intermediates,⁶ the area is still in its infancy and ripe for further elaboration.



In his project, the development of molecular group 2 reagents capable of the most challenging bond (C-H, C-C, N₂) activation processes and their onward transformation to useful products will be addressed. To achieve this, a variety of organometallic, hydrido and low oxidation state derivatives of Mg, Ca, Sr and Ba will be stabilised. The reactivity of these new species will be assayed toward relevant small molecules under both thermal and photochemically activated conditions. Any new transformations, which will be assessed computationally through DFT methods, by Prof. L. Maron (University of Toulouse), who has a strong history of collaboration with both the Bath and Monash research groups.

¹ Hill, M. S.; Liptrot, D. J.; Weetman, C, *Cherm. Soc. Rev.*, **2017**, *45*, 972; ² (a) Green, S. P.; Jones, C.; Stasch, A., *Science* **2007**, *318*, 1754; (b) Jones, C., *Nature Rev. Chem.* **2017**, *1*, 0059; ³ Wilson, A., Dinoi, C., Hill, M., Mahon, M. & Maron, L., *Angew. Chem. Int. Ed.* **2018**, *57*, 47, p. 15500; ⁴ Wilson, A.; [Hill, M. S.](#); [Mahon, M.](#); Dinoi, C.; Maron, L., *Science*, **2017**, *358*, 1168; ⁵ (a) Paparo, A.; Yuvaraj, K.; Matthews, A. J. R.; Douair, I.; Maron, L.; Jones, C., *Angew. Chem. Int. Ed.* **2021**, *60*, 630; (b) Anker, M. D.; Kefalidis, C. E.; Yang, Y.; Fang, J.; Hill, M. S.; Mahon, M. F.; Maron, L., *J. Am. Chem. Soc.* **2017**, *139* (29), 10036-10054; ⁶ (a) B. Rösch, T. X. Gentner, J. Langer, C. Färber, J. Eysel, L. Zhao, C. Ding, G. Frenking, S. Harder, *Science*, **2021**, *371*, 1125; (b) R. Mondal, K. Yuvaraj, T. Rajeshkumar, L. Maron, C. Jones, *ChemRxiv*, **2022**, DOI:10.26434/chemrxiv-2022-dcqc3.

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 30th January 2023

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.