THE UNIVERSITY of EDINBURGH
School of Chemistry

Developing more efficient routes to organoboranes: [BF_4] salts as sustainable precursors for borylation chemistry

A PhD studentship is available in the group of Prof. Michael Ingleson at the University of Edinburgh, School of Chemistry, for group details see: https://www.ingleson.chem.ed.ac.uk/. This PhD involves collaborations with Professor Stephen Thomas (University of Edinburgh) and Professor Allan Watson (University of St. Andrews) at various points in the project.

The studentship is fully funded for 42 months by the University of Edinburgh and covers tuition fees and an annual stipend at the UKRI rate, for 2024-25 this was £19,237 per annum, for a candidate satisfying EPSRC residency criteria. The UKRI will normally limit the proportion of international students appointed each year.
https://www.ukri.org/councils/esrc/career-and-skills-development/funding-for-postgraduate-training/eligibility-for-studentship-funding/#contents-list

Project Summary

Organoboranes are crucial synthetic intermediates widely used in academia and industry, while they are also increasingly important in their own right, including in pharmaceuticals (see: Ganfeborole, Vaniborbactam, Tavaborole). However, C-B bonds are generally synthesised using compounds that are energy intensive to make (e.g., B-B, B-H, B-Br containing precursors). The recent discovery (Nature 2024, 635, 359) that $[BF_4]^-$ salts can be made directly from the ubiquitous mineral CaF_2 (fluorspar) in water using benign/cheap reagents (boric acid) has made $[BF_4]^-$ arguably the most sustainable reactive boron precursor. This project will use $[BF_4]^-$ salts as the entry point to make known and novel borane reagents in-situ for direct use in the synthesis of organoboranes. Furthermore, by using $[BF_4]^-$ salts and simple activators we will develop novel routes to form C-F bonds and BO heterocycles (e.g., analogues of Xeruborbactam).[1] Both of these are important in the pharmaceutical industry. Through this we will address the UK priority goal of "*shifting us away from environmentally detrimental industries and processes to more sustainable systems".*
This project is underpinned by proof of principle results and calculations and will allow the successful applicant to develop skills in organic and inorganic synthesis, catalysis, DFT calculations and a range of key characterization techniques (enabled by access to state-of-the-art facilities at the University of Edinburgh).

References

For a recent publication from the Ingleson Group in a topic related to this project see:
Haloboration of o-Alkynyl Phenols Generates Halogenated Bicyclic-Boronates. *Angew. Chem. Int. Ed*. **2023**, 62, e202301463. K. Yuan and M. J. Ingleson.*
https://onlinelibrary.wiley.com/doi/10.1002/anie.202301463

How to Apply

In the first instance, informal enquiries accompanied by a CV should be e-mailed to:
Professor Michael Ingleson, School of Chemistry, University of Edinburgh.
Email: michael.ingleson@ed.ac.uk

The position will remain open until filled.

The start date is usually the beginning of the academic year, for the Chemistry PhD Programme this is 1 September 2025

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IMPORTANT
Before Submitting your cover letter and CV, please complete the online School of Chemistry Equality, Diversity and Inclusion Form, entry 2025-26.

The form will automatically generate a unique 'Response ID number' that you must include in your cover letter.

Equality and Diversity
The School of Chemistry holds a Silver Athena SWAN award in recognition of our commitment to advance gender equality in higher education. The University is a member of the Race Equality Charter and is a Stonewall Scotland Diversity Champion, actively promoting LGBT equality.

The University has a range of initiatives to support a family friendly working environment.
For further information, please see our University Initiatives website:
https://equality-diversity.ed.ac.uk/inclusion/family-and-carer