THE UNIVERSITY of EDINBURGH
School of Chemistry

New approaches to the turnover of main-group catalysts for a circular chemical economy

A PhD studentship is available in the group of Dr Richard Yuze Kong at the University of Edinburgh; School of Chemistry, see https://www.ed.ac.uk/profile/dr-richard-y-kong

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 is £19,237 per annum, for a candidate satisfying EPSRC residency criteria. For details, see:

https://www.ukri.org/councils/esrc/career-and-skills-development/funding-for-postgraduate-training/eligibility-for-studentship-funding/#contents-list

Project Summary

The chemical upgrading and recycling of C1 feedstocks is of immense importance in the development of a circular chemical economy. A key challenge within this field is the generation of C2+ molecules from simple C1 feedstocks with high selectivity. The mechanism for formation of C–C bonds in these processes is often opaque (e.g. in the Fischer-Tropsch process), hampering development of catalysts to transform C1 feedstocks into fine chemicals. By contrast, numerous homogeneous systems have achieved selective metal-mediated reduction and coupling of carbon oxides (CO, CO_2) [1]. Few approaches, however, are amenable to catalysis due to the harsh reagents (KC_8, Na, etc.) involved in the synthesis of the starting metal complexes and their incompatibility with CO under reaction conditions.

This project will explore new approaches for the generation of reactive main-group species to effect CO homologation [1]. The project will use a combination of synthetic, spectroscopic, and computational methods to understand nuances within reactivity and employ this understanding towards the development of catalytic methodologies. The work builds on our preliminary results in exploring how bimetallic cooperativity and subtle changes to electronic structure can effect macroscopic changes within catalysis.[2]

This project will employ techniques in air-free inorganic synthesis (Schlenk line, glovebox, vacuum line), characterization (NMR, IR, mass-spec, SC-XRD, UV-VIS), computational methodology (reaction modelling, electronic structure calculations, TD-DFT), and X-ray absorption spectroscopy. Experience in synthetic inorganic chemistry is desirable, but not essential. Candidates should be able to demonstrate problem-solving, time-management, and independence in thinking.

Applicants should hold, or be on track to obtain, a 1st or 2:1 M-level qualification in chemistry. Informal enquiries are encouraged and should be directed to Dr Richard Kong (rkong@ed.ac.uk).

In the first instance, the initial application of cover letter sent to:

Dr Richard Kong, School of Chemistry, University of Edinburgh, David Brewster Road, Edinburgh EH9 3FJ, UK. (rkong@ed.ac.uk)

The position will remain open until filled. A closing date may be added at a later date.

References

[1] a) N. M. West, A. J. M. Miller, J. A. Labinger and J. E. Bercaw, *Coord. Chem. Rev.*, 2011, **255**, 881–898. b) R. Y. Kong and M. R. Crimmin, *Dalton Trans.*, 2020, **49**, 16587–16597. c) S. Fujimori and S. Inoue, *J. Am. Chem. Soc.*, 2022, **144**, 2034–2050. d) H.-Q. Liang, T. Beweries, R. Francke and M. Beller, *Angew. Chem., Int. Ed.*, 2022, **61**, e202200723.

[2] R. Y. Kong, J. B. Parry, G. R. Anello, M. E. Ong and K. M. Lancaster, *J. Am. Chem. Soc.*, 2023, **145**, 24136–24144.

Important
Before Submitting your cover letter and CV, please complete the online form:

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