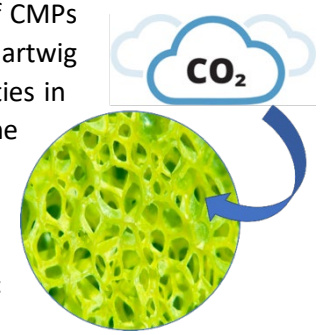
Conjugated microporous polymers for gas capture and conversion

About: The depletion of traditional fossil fuels on such a comprehensive scale has led to calamitous global climate change and severe environmental concerns. Increasing carbon dioxide (CO_2) emissions is considered to be the main cause of global warming. To combat this global challenge, considerable research efforts have focused on the capture of CO_2 and its utilisation as a carbon source for the production of fuels and commodity chemicals.

Nanoporous materials have demonstrated the ability to adsorb CO_2 allowing for it to be stored at high densities under certain conditions. A specific class of nanoporous polymer known as conjugated microporous polymers (CMPs) are highly cross-linked three-dimensional porous networks having both high thermal and chemical stability. CMPs have been used in a range of applications, including the adsorption and capture of gases such as CO_2.



The focus of this project will be on the design and synthesis of a range of CMPs using an established metal catalysed cross-coupling reaction (Buchwald—Hartwig coupling), specifically exploring the inclusion of additional carbonyl moieties in the framework structure to enhance CO_2 uptake. Characterisation of the physical properties of the resulting material will be conducted using standardised techniques including: gas sorption analysis (to determine specific surface area, pore volume and pore size), thermogravimetric analysis, X-ray diffraction, ultraviolet-visible spectroscopy, cyclic voltammetry, and electron microscopy.

Why: Your skills in materials chemistry will increase as well as your understanding of characterisation techniques. This project will allow for collaboration with other members within the Faul Research Group and encourage growth in teamwork and networking skills. Your scientific writing and presentation skills will also improve throughout your time within the group. Full training will be provided for all aspects of this project. You will be embedded in the large, international and dynamic Faul Research Group (faulresearchgroup,com), who will provide support. In addition, you will be assigned a student mentor for the duration of your project, who will provide extra support and help you to identify any additional training needs or opportunities

About you: General synthetic and analytical chemistry lab skills, some experience with graphing software and Microsoft Office suite would be beneficial.

Bench fees: A bench fee of £10,000 is required.

How to apply: Applications are accepted throughout the Academic Year, and you the online application form for Chemistry (MSc by Research).

Supervisor: Your supervisor for this project will be Charl Faul, Professor Chemistr Chemistry. Please see faulresearchgroup.com and @FaulResearch for further details. You can contact him at +44 (0) 117 954 6321 or email charl.faul@bristol.ac.uk

More information on CMPs: The following review article explains the current advances in CMPs: J.-S. M. Lee and A. I. Cooper, Advances in Conjugated Microporous Polymers, *Chem. Rev.*, 2020, **120**, 2171–2214. Relevant recent papers from the Faul Research Group:

"Exploiting Hansen Solubility Parameters to Tune Porosity and Function in Conjugated Microporous Polymers", *J. Mater. Chem. A,* **2020**, *8*, 22657

"Tuneable Surface Area, Porosity and Function in Conjugated Microporous Polymers", *Angew. Chem. Int. Ed.,* **2019**, *58*, 11715