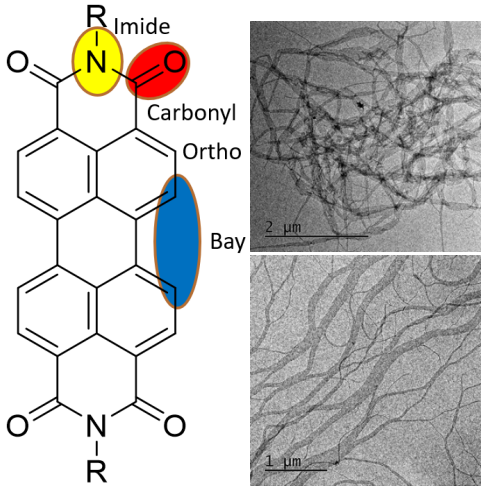
Chemical Modification of PDI-Based Supramolecular Polymers

About the project or challenge area: The development of novel materials to produce well-defined superstructures of semiconducting polymers is of interest in a wide range of application areas – whether as active materials for energy conversion or storage applications, or for novel organic catalysts eliminating the need for expensive or scarce rare-earth metals. Control over the formation of function and structure in novel supramolecular polymers (SMPs) is therefore of significant interest. The application of perylene diimide (PDI) based materials is a main interest in our group. Finding different tools to control the resulting structures is of significant importance, including new chemical modifications of the materials, which is the main objective of this project. Here the "N"-annulation of the bay position (NPDI) will be explored as a novel way to tune morphologies and function of the resulting SMPs.



Why choose this opportunity? The focus of your project will be on novel modifications of perylene diimides by synthesizing "NPDIs" and the characterization of the resulting supramolecular polymers, which will provide an excellent platform to learn about the design of functional materials and their practical applications. Your work in this area can make a real impact on global challenges, such as creating recyclable dynamic functional polymer systems. You will develop and increase your expertise in broad chemical synthesis and characterization techniques, whilst becoming familiar with the fundamentals of supramolecular science. Furthermore, this project will require your collaboration with other members across other research groups, thus improving your teamwork and networking skills. You will also develop a range of transferable skills, including presentation, scientific writing, and project and time management. Finally, you will be interacting with students from all over the world, learning from their culture and skills, adding to your professional and personal development.

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: Ideally you will already have skills and knowledge in general preparative chemistry, analytical methods, polymer science, teamwork and time management.

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

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

Supervisor:

Your supervisor for this project will be Charl Faul, Professor Chemistry in the School of 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

Find out more about your prospective research program: This review article from the Faul Research Group explains the general background to perylene supramolecular polymers:
Design and Control of Perylene Supramolecular Polymers through Imide Substitutions, Chem. Eur. J. 2022, 28, e202103443.
https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/chem.202103443

This article from the Welch group further explains the modification by "N"-annulation and the resulting advantages:
Improved performance of solution processed OLEDs using N-annulated perylene diimide emitters with bulky side-chains, Mater. Adv., 2021,2, 933-936; https://doi.org/10.1039/D0MA00827C