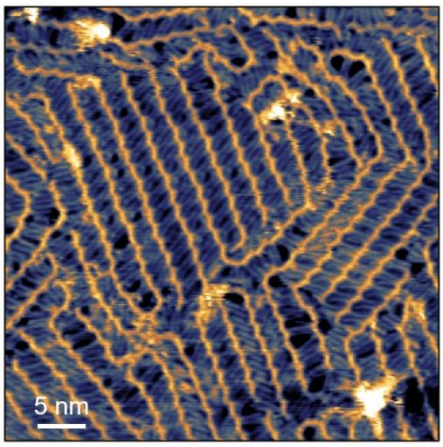
UNIVERSITY OF BIRMINGHAM

PhD project: High-Resolution Imaging of Green Conjugated Polymers

A fully funded 3.5 years PhD position in the field of experimental nanoscience at surfaces and molecular imaging of conjugated polymers is available in the group of Prof. Giovanni Costantini at the University of Birmingham.



About the research: Conjugated polymers are gaining popularity as substitutes for inorganic semiconductors in advanced devices due to their tuneable chemical structures, low cost, flexibility, and biocompatibility. They find applications in various fields, from organic photovoltaics and thermoelectrics, to (bio)medical devices and neuromorphic computing. Since traditional polymerisation methods typically involve environmentally harmful processes, greener alternatives are strenuously researched, and arylation polymerisation (DArP) stands out for its simplicity, cost-effectiveness and lower toxicity. However, DArP often results in polymers with increased structural defects, impacting performance. Identifying and understanding these defects is crucial for refining DArP synthesis. Current methods rely on inefficient trial and error due to the difficulty of characterising these defects using traditional analytical techniques.

About the project: The Costantini Lab has recently demonstrated that by combining electrospray deposition (ESD) with scanning tunnelling microscopy (STM) it is possible to deposit intact conjugated polymers in ultrahigh vacuum (UHV) and to acquire unprecedented sub-molecular resolved images. This breakthrough started a transformative new approach for the characterisation of conjugated polymers leading, for the first-time, to a molecular-scale characterisation of these functional macromolecules (e.g. *Sci. Adv.*, 2018; *Adv. Mater.*, 2020; *JACS*, 2021; *ACS Nano*, 2022; *Adv. Funct. Mater.*, 2023). In this project, the ESD-STM technique will be applied to study DArP conjugated polymers in order to determine the precise sequence of their backbones, to identify structural defects and their possible statistical correlations, to establish the polymer assembly patterns and to acquire the polymer mass distribution. Since this type of information cannot be achieved with any other present analytical technique, this project has the potential to deliver pioneering results of high fundamental and applied impact.

What we offer: The successful candidate will have access to a unique ESD-STM equipment to perform world-leading research. They will learn how to operate state-of-the-art sophisticated experimental setups working closely with senior researchers and experts in the field. They will be fully embedded into the highly collaborative and interdisciplinary research environment of the Costantini Lab. Their work will be firmly rooted in experimental nanoscience at surfaces but will ultimately be directly applied in the design of greener and more functional advanced electronic materials. The project will be in collaboration with world leading synthetic groups at the University of Cambridge (UK), University of Oxford (UK), Chemnitz University of Technology (Germany), Princeton University (USA) and Georgia Tech (USA).

Who we are looking for: Motivated students are welcome from various backgrounds, including physics, chemistry, engineering, and material science. However, we are particularly interested in applications from students with a strong preference for hands-on experimental work, not shy of operating, optimising (and sometimes repairing) complex experimental instruments involving mechanical, electronic and vacuum technology and know-how. A strong drive and curiosity for understanding the deep origins of physical and chemical processes and phenomena is essential. Applicants with previous experience in scanning probe microscopy and/or surface science are particularly welcome.

Funding for this position is open to **UK applicants** and the 3.5 years studentship will **start in October 2024**.

Enquiries and informal applications should include a C.V. and be addressed as soon as possible to Prof. Giovanni Costantini (g.costantini@bham.ac.uk).