



The  
University  
Of  
Sheffield.

## 3.5 years PhD studentship, starting October 2020

In two-dimensional nanosheets for sensing: synthesis and spectroscopic study

### Project description

The goal of this project is to enhance the selectivity of graphene-based sensors by adding a layer of another 2D material: metal-organic nanosheets (MONs). The project builds on a recent £1.8M international and multidisciplinary research venture (NSF-NERC, Signal in the Soil), in which we are developing micro-structured graphene sensors for the real-time detection of phosphate and other small molecules in the soil.

MONs are an emerging class of graphene-like two-dimensional nanomaterials. MONs combine the diversity of organic compounds with the unique properties of metal ions in a modular way that allows their properties to be tuned systematically. Their very high surface area, readily tunable chemistry and nanoscopic dimensions make them ideal for use in sensing, catalysis, electronics and separation applications.

In order to explore the fundamental electronic processes that gives MONs their unique properties, we propose to use a characterisation technique called ultrafast transient spectroscopy. Ultrafast spectroscopy makes use of high power lasers to generate ultra short ( $10^{-15}$  seconds in duration) flashes of light that are used to probe the electronic structure and dynamics of the materials. This techniques is unique in the sense that it gives insight about the electronic processes that takes place in the materials, in “real time”.

This project will be a joint synthetic and spectroscopic study, co-supervised by Dr Jonathan Foster (MONs synthesis) and Dr Adrien Chauvet (ultrafast spectroscopy). In Dr Foster’s group, you will develop novel MONs incorporating different functional groups on their surface. In Dr Chauvet’s group, you will then explore the electronic properties and investigate the surface-analyte interactions of the newly developed sensors using the latest time-resolved ultrafast spectroscopy equipment available in the Lord Porter Laser Laboratory. With this dual approach, you will be able to correlate between composition, structure and sensing properties of the materials and inform the development of new sensors.

You will develop skills in organic, inorganic and nanomaterials synthesis as well as use a wide variety of characterisation techniques (including ultrafast transient spectroscopy, x-ray diffraction, atomic force microscopy, electron microscopy).



## Eligibility

You are an enthusiastic and self-motivated student that has, or expects to receive, a 1st class or 2.1 MChem degree or equivalent in Chemistry or related subject.

**This studentship is open to UK and EU applicants only. UK applicants and EU applicants who have been ordinarily resident in the UK for at least 3 years prior to the start of the studentship are eligible for a fully-funded studentship (fees and a stipend).** EU citizens who did not have lived in the UK for the last 3 years preceding the start of the studentship would normally be eligible for a Fees Only Award. The Fee Award does not include a stipend, therefore additional funding to cover living costs for at least 3 years need to be sought from another source.

## How to apply

The application **deadline is the 2<sup>nd</sup> March 2020**. Please apply online at:  
<https://www.sheffield.ac.uk/postgraduate/phd/apply/applying>

For more information about the project, please contact Dr Adrien Chauvet ([a.chauvet@sheffield.ac.uk](mailto:a.chauvet@sheffield.ac.uk)) or Dr Jonathan Foster ([jona.foster@sheffield.ac.uk](mailto:jona.foster@sheffield.ac.uk)).

The University of Sheffield is a **world top 100 university** and **world top 50 most international**, situated at the edge of Sheffield's historical downtown, and only 6km away from the Peak District national park with direct train connections to London (2.5h), Manchester (1h) and Leeds (<1h). We build teams of people from different heritages and lifestyles from across the world, whose talent and contributions complement each other to greatest effect. We believe diversity in all its forms delivers greater impact through research, teaching and student experience.

We are looking forward to hearing from you.

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<https://teamchauvet.com/>

<https://foster.group.shef.ac.uk/>

<https://www.sheffield.ac.uk/faculty/science/research/facilities/laserlab>

