Title: Hydrogen Production for Clean Energy

Institution: University College London

Qualification type: PhD

Location: London

Funding for: UK/EU/EEA students

Duration: 48 months (starting on 1 October 2016)

Funding amount: Not specified

Hours: Full Time

Placed on: March 2016

Closes: Friday 22 April 2016

We are inviting applications for a fully funded 4-year PhD project in the area of surface chemical physics in Prof Geoff Thornton’s research group <http://www.ucl.ac.uk/chemistry/research/group_pages/nano/> at the London Centre for Nanotechnology, University College London, and in close collaboration with Imperial College and Diamond Light Source. This funding stream requires applicants to be home students\*. The student would form part of the 2016 cohort of the Advanced Characterisation of Materials Centre of Doctoral Training.

Two polymorphs of TiO2, rutile and anatase remain the subject of intense research associated with their photocatalytic properties. Indeed, understanding how the TiO2/water system works at the level of individual atoms and molecules is one of the grand challenges of contemporary physical science. In this project we will investigate the photostability of the TiO2/water interfaces, with the aim of characterising the species generated on single crystal substrates by a UV Hg lamp. This will employ UHV scanning tunnelling microscopy/spectroscopy and photoemission at UCL as well as UHV and high pressure photoemission at Imperial and Diamond Light Source.

STM and photoemission are the techniques of choice to look at local changes to the structure and electronic properties induced by UV light. For STM we will use a method developed at UCL to form a clean interface by dipping the single crystal in water, which forms a 2x1 ordered overlayer of terminal OH groups after pumping off the physisorbed water. The dipped surface can be UV-irradiated *in-situ* before examining the pumped-off surface in UHV with STM as well as XPS, UPS and scanning tunnelling spectroscopy in the same instrument at UCL. Together, these data will allow UV-generated chemical species to be identified and mechanisms to be derived. This will be used to inform our overall understanding of the photocatalysis process. To complement this we will also perform high-pressure photoelectron spectroscopy (HiPPES) measurements at Imperial. This will be done using a recently commissioned state-of-the-art instrument capable of performing photoemission measurements at water pressure greater than 25 mbar. We will also be able to irradiate the surface *in-situ* using an in-built UV lamp as well as studying the role of co-adsobents (such as O2) on the TiO2/water interface.

It is important to connect the atomically resolved mechanistic data obtained in the Thornton group with measurements under more realistic conditions. This can be achieved using photoemission data, with high-pressure results being obtained using an instrument at Imperial, complemented with synchrotron radiation measurements using HiPPES on beamline B07 at the Diamond Light Source.

The student would gain skills associated with the use of surface science instruments at UCL: UHV scanning tunnelling microscopy and spectroscopy as well as XPS and UPS. At Imperial they would gain experience of using a complex dual-use UHV and high-pressure instrument, and at Diamond they would learn to use synchrotron radiation instrumentation.

We seek candidates for October 2016 entry. You will hold, or be expected to achieve, a Master's degree in addition to a Bachelor's degree (or equivalent) at 2:1 level (or above) in a relevant subject (e.g. Physics, Chemistry).

Applications will be handled in two stages:

Stage 1: Send a full CV, including the marks (%) for all (undergraduate) modules completed to date and including a clear description of previous research project experience, as well as a covering letter and contact details of two academic referees, to Prof Geoff Thornton (g.thornton@ucl.ac.uk). Applications that do not provide this information cannot be considered.

Stage 2: Suitable applicants will be interviewed, and if successful invited to make a formal application.

\* European Union / EEA nationals who have been ordinarily resident in the UK for a period of at least three years prior to starting the studentship, not including time for higher-education.