Neuromorphic devices based on oxidation-conversion of van-der-Waals semiconductors

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Project ID: 2228cd1399 (You will need this ID for your application)

Research Theme: Advanced Materials

UCL Lead department: London Centre for Nanotechnology (LCN)

Department Website

Lead Supervisor: Antonio Lombardo

Project Summary:

Why this research is important Taking inspiration from the human brain, neuromorphic systems uses physics of materials and devices to process unstructured and noisy analogue data, leading to a fundamentally new approach to computing. With tens of materials experimentally available and over 2,000 theoretically predicted, 2D materials are among the most promising material systems to support neuromorphic technology. In particular, the chemical conversion of 2D materials enables synthesis of ultra-thin insulators and atomically-sharp semiconductor-dielectric interfaces by changing composition and phase of an initial material while preserving its shape, leading to a novel approach for precise assembling of nanodevices.

Who you will be working with The successful candidate will be part of the NanoElectronic Devices Group and work with other postgraduate students and postdoctoral research associates. The group has extensive expertise on 2D materials and dedicated facilities for production/processing (incl. oxidation). She/he will also work with the research groups of Prof. Shulger, Prof. Kenyon and Dr Mehonic, to compare experimental results against theory (and viceversa) and evaluate the performance of 2D-based memristors for applications in cross-bar arrays and machine learning tasks.

What you will be doing The project will involve systematic investigation of oxidation of hafnium, zirconium and gallium sulphides and selenides, as well as design, microfabrication and testing of memristors based on such oxides. Flakes of different thickness will be obtained from bulk crystals, and different oxidation methods will be investigated. Devices will be fabricated using a combination of standard clean-room based and 2D material-specific microfabrication, already available in the group. Electrical characterization will be performed in a probe station setup coupled with DC, RF and pulsed testing equipment.

Who we are looking for The successful candidate will have first class honours undergraduate degree and/or post-graduate master's qualification in electronic engineering, physics, nanotechnology, computer science or closely related disciplines.
