

Dr Robert Menzelr.menzel@leeds.ac.uk

This proposal is representative of the projects currently on offer in our group. For more details of active research projects, please visit our webpage at: <http://www.chem.leeds.ac.uk/People/Menzel.html>

Graphene and Carbon Nanotube Aerogels: Chemical Functionalisation of the Internal Surface for Applications in Heterogeneous Catalysis and CO₂ Storage

Nanocarbons, such as carbon nanotubes and graphene, have gained great academic and, more recently, commercial interest due to their many extraordinary properties, among them exceptional mechanical strength, excellent thermal and electrical conductivity, and unique optoelectronic properties.¹ Aerogels are low-density, 3D networks that possess a defined shape and exhibit extremely large porosities. Nanocarbon aerogels² can provide a practical form for real-world applications of carbon nanotubes and graphene that require access to large surface areas, e.g. in energy storage devices, catalyst support frameworks or adsorber systems.

The aim of the project is to chemically functionalise the internal surface of aerogels, made of graphene or carbon nanotubes, in order to widen their potential areas of application. Chemical functionalization will be achieved through a novel, thermochemical gas-phase methodology³ that will enable the introduction of a wide range of functional groups to the internal pore surfaces without compromising the unique properties of the nanocarbon aerogels. The introduced groups will be either directly used as active functional sites or will facilitate the decoration of the internal aerogel surface with catalyst/adsorber nanoparticles. The functional properties of the chemically-modified aerogels will be assessed in typical, commercially-relevant catalytic model reactions and through the investigation of their CO₂ storage capabilities.

This project will combine fundamental investigations of novel nanomaterials with more application-oriented investigations. The PhD candidate will obtain multidisciplinary research training in inorganic synthesis, surface chemistry, advanced nanomaterials and surface characterisation, and testing of application-relevant properties. The project will benefit from strong links with the Leeds Electron Microscopy and Spectroscopy Centre and with the Institute for Process Research and Engineering.

Please contact Dr Robert Menzel (r.menzel@leeds.ac.uk) for further details about this opportunity.

References

- [1] Hong, Coleman, Kostarelos et al *Nature Nanotech.* **2014**, pp737; Schnorr et al *Chem. Mater.* **2010**, 23(3), 646;
 [2] Menzel et al. *Adv. Funct. Mater.* **2015**, 25, 28; Nardecchia et al *Chem Soc Rev* **2013**, 42, 794;
 [3] Menzel et al. *Chem. Sci.*, **2010**, 1, 603.

