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I am originally from South Wales and when I was in the sixth form at school, a Nuffield Science Bursary summer placement (2009) in Dr Benjamin Ward's research group, Cardiff University, initiated an interest and subsequent pathway into chemical research.

My MChem studies (direct 2nd year entry) were carried out at the University of St Andrews, after having won a Purdie Scholarship and graduated with first class honours in June 2014. Central to the degree was a one year external placement (2012-2013), carried out at SINTEF Materials and Chemistry, Trondheim (Norway).

Remaining at the University of St Andrews, I began PhD studies in July 2014 having joined Prof Paul Wright's research group. My research focuses on synthesizing metal-organic frameworks (MOFs) as nanoparticles, with exceptional CO_2 adsorption capacities and integrate them into polymer-based membranes for CO_2 capture and separation from flue streams of power plants. This research has been implemented for the EU collaborative project E=M4CO2 (Energy efficient MOF-based Mixed Matrix Membranes for CO_2 capture).

I was awarded an SCI Scholarship 2015/2016 for my PhD research and have since joined the SCI Scotland committee, become the SCI ambassador within the Chemistry department at St Andrews and am taking part in the SCI mentoring scheme as a student.

Presentation abstract: 'Metal-organic frameworks: porous materials for carbon capture'

Metal-organic frameworks (MOFs) are a sub group of porous materials with extended crystalline structures, composed of metal clusters connected, through coordination bonds, by di-, tri- or tetra dentate organic ligands. The favourable features of MOFs include: high porosity, large internal surface area, adjustable pore dimensions and frameworks that can be functionalised as well as being flexible or rigid. Consequently, MOF applications include: gas storage, gas and liquid phase chemical separations, heterogeneous catalysis, drug delivery and storage and chemical sensing.

The burning of fossil fuels for energy production is the biggest emitter of the greenhouse gas, CO2 (globally 76.6% of CO_2 emissions in 2009 were from fossil fuel burning). Research into several novel materials for carbon capture and storage (CCS) technologies is ongoing and MOFs are one such category with promising applicability.

In this presentation, I will provide an overview of the new synthetic routes to the highly stable bisphosphonate MIL-91 series (Materials Institut Lavoisier), Al(III) and Ti(IV) forms. These alternative routes can be scaled up for large scale production, produce submicron sized particles (providing the opportunity for inclusion into polymer based membranes), whilst maintaining good gas adsorption properties.