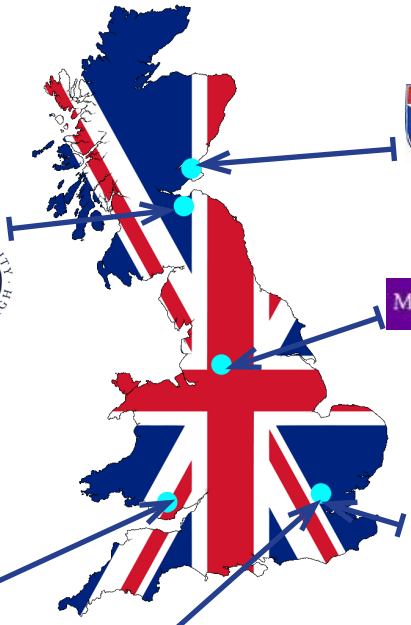
ADSORPTION RESEARCH AT THE SCHOOL OF ENGINEERING

INNOVATIVE GAS SEPARATIONS FOR CARBON CAPTURE (IGSCC)

EPSRC Pioneering research and skills

The EPSRC (EP/G062129/1) has awarded a key number of academic institutions, with the University of Edinburgh (UoE) as coordinator, funding worth £2,081,429 (Oct 2009 to Mar 2013) to focus on the development of methodologies for the rapid synthesis and screening of novel materials and solvents for carbon capture from power stations.

ACADEMIC PARTNERS



University of Edinburgh
- Prof. Stefano Brandani
- Dr Hyungwoong Ahn
- Dr Tina Duren
- Dr Maria-Chiara Ferrari
- Dr Daniel Friedrich
- Dr Lev Sarkisov
- Mr Linjiang Chen (PhD)
- Mr Wenli Dang (PhD)
- Ms Emanuela Di Biase (PhD)
- Ms Zoe Kapetaki (PhD)
- Mr Enzo Mangano (PhD)

University of St Andrews
- Prof. Paul Wright
- Prof. Russell Morris
- Mr Juergen Kahr (PhD)
- Ms Magdalena Lozinska (PhD)

University of Manchester
- Prof. Peter Budd
- Dr Flor Siperstein
- Ms Laura Leay (PhD)
- Ms Hosna Shamsipour (PhD)

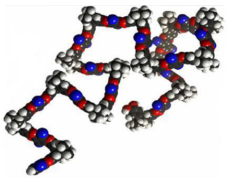
University College London
- Prof. Eric Fraga
- Prof. Xiao Guo
- Mr Joakim Back (PhD)
- Mr William Travis (PhD)

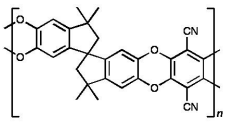
University of Cardiff
- Prof. Neil McKeown
- Mr Matthew Croad (PhD)

Imperial College London
- Dr Claire Adjiman
- Dr Paul Fennell
- Dr Amparo Galindo
- Prof. George Jackson
- Dr Niall MacDowell
- Mr Charles Brand (PhD)
- Ms Danlu Tong (PhD)

MATERIALS

1 POLYMERS OF INTRINSIC MICROPOROSITY

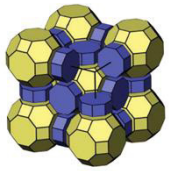




PIMs behave like molecular sieves and are a promising material for membranes.

2 MEMBRANES

3 ZEOLITES

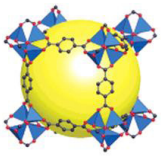


Several types of Mesoporous Silicas and Zeolites (e.g. RHO; K,H-Chabazite)

4 CARBON MATERIALS

Carbons with different surface functional groups (e.g. BPL-Piperazine, BPL-Crown ether, BPL-Benzeneacetamide)

5 METAL-ORGANIC FRAMEWORKS (MOFS)



Properties that make MOFs suitable materials for CO_2 capture:
- Ordered structures with high thermal stability
- 100's of crystalline, well-characterised porous structures
- Adjustable chemical functionality

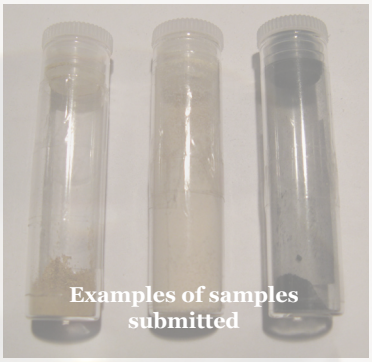
For more information, please contact: s.brandani@ed.ac.uk www.eng.ed.ac.uk/carboncapture

Testing the materials

Aims

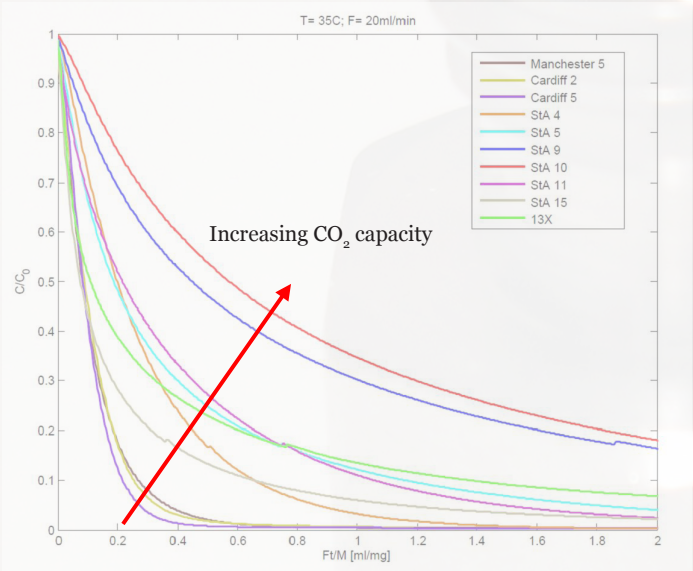
1 Materials for CO2 capture

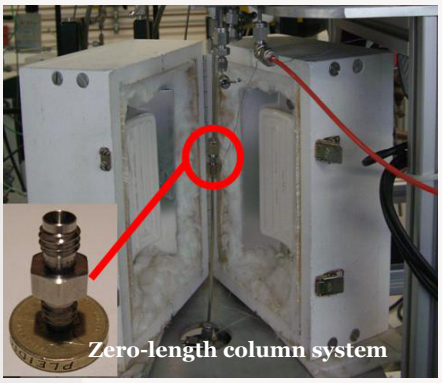
--> To develop novel design and synthesis routes for materials and solvents for carbon capture technologies applied to power stations.


Examples of samples submitted

The novel materials for carbon capture from power plants are mainly being developed by the universities of St Andrews, Cardiff, and Manchester.

They are then tested using the ZLC system at Edinburgh and ranked according to CO_2 capacity.




Zero-length column system

Advantages of the ZLC:

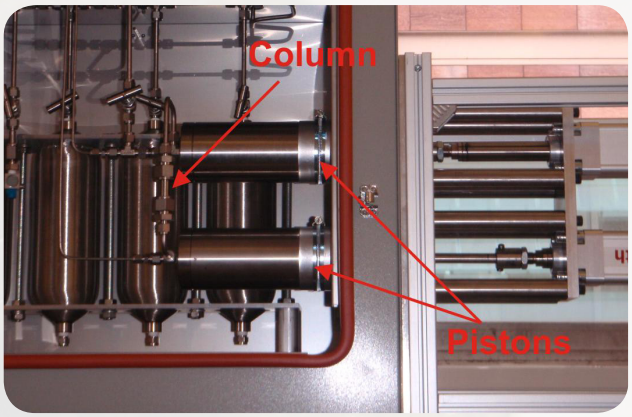
- Rapid screening of the materials
- Rapid ranking of the samples' CO_2 capacity
- Requires only small amount of sample (5-15 mg)
- Results easily interpreted
- Can determine kinetics
- Can test the materials with water, SO_x and NO_x
- Negligible heat and mass transfer resistances

Modelling

2 Molecular and process modelling

--> To screen materials and solvents both experimentally and via molecular and process modelling approaches, thereby informing the choice and design of the materials.

A Dual Piston Pressure Swing Adsorption system is being used to test materials for the separation of CO_2 from flue gas.



3 Process modelling of solvent-based techniques and integration in power plants

--> To undertake both precombustion and postcombustion separations, including benchmark reference simulation of current technology (amines, Selexol).

--> To predict the performance and optimisation of novel gas separation processes coupled to power stations in both steady-state and transient operation.