

Location:

Dovedale Room, The Ridge - University of Sheffield - Shore Lane, Sheffield, S10 3AY, UK

Agenda for Scientific Workshop

Date: Tuesday 20th March | **Start time:** 14:00 | **End time:** 17:30

Project background: The NanoMaterials Enhanced Membranes for Carbon Capture (NanoMEMC²) project aims to reduce the cost, energy and process limitations that make pre- and post-combustion CO₂ capture non-viable in many industrial applications at present. Through the development of innovative materials, membranes and membrane processes for carbon capture, the project aims to make possible a substantial reduction in energy penalty, a much lower cost and a reduction of CO₂ emissions.

Workshop aim: The scientific workshop focuses on highlighting the research capabilities of the academic partners in the area of carbon capture. This will enable the participating universities to showcase and disseminate their high-profile work in this field, outlining previous research and linking it to the current NanoMEMC² programme. This will identify how we are collectively contributing to the development and deployment of low-carbon technologies, specifically membrane-based separation processes.

13:30 - Registration and poster set-up

14:00 - Welcome and introduction (Prof Mohamed Pourkashanian/Dr Marco Giacinti Baschetti)

14:25 - Talks from the scientific NanoMEMC² partners (Chair: Dr Karen N Finney)

1. *Alma Mater Studiorum – Università Di Bologna: Material properties of hybrid membranes [Dr Maria Grazia De Angelis]*
2. *University of Edinburgh: Membrane permeation and modelling [Prof Lev Sarkisov]*
3. *Norges Teknisk-Naturvitenskapelige Universitet: Nanocellulose-based membranes for CO₂ separation applications [Dr Luca Ansaloni]*
4. *University of Sheffield and the UKCCSRC: Carbon capture activities and vision in the UK – Testing capture at a pilot-scale for carbon-intensive sectors [Prof Mohamed Pourkashanian and Dr Muhammad Akram]*

16:10 - Coffee break and poster session

The session will allow all workshop participants to discuss further the work conducted by the academic partners within the project, through the use of posters presented by each institution. Posters are invited from all workshop participants.

16:45 - Technical panel: Discussion of the NanoMEMC² project findings so far and impacts of future work and deployment (Facilitator: Prof Mohamed Pourkashanian)

[panel members will include scientific NanoMEMC² partners, as well as other members of the consortium and advisory board]

17:30 - Session closes

Summaries for scientific talks:

- **Alma Mater Studiorum – Università Di Bologna: Material properties of hybrid membranes** [Dr Maria Grazia De Angelis]

The Diffusion in Polymers research group within the Department of Civil, Chemical, Environmental and Material Engineering develops and tests membrane materials in order to assess their mass transport properties. This primarily focuses on polymeric films and membranes, conducted through experimental and modelling evaluations. The group aims to optimise the material properties for a range of applications, including high efficiency carbon capture. For the NanoMEMC² project, material development will focus on facilitated transport and continuous phase hybrid membranes, with the resultant materials tested under a wide range of operating conditions relevant for CO₂ separation and capture. Based on the results of these tests, further development of the structure and properties of the membranes can be undertaken. The construction of macroscopic models for the description and prediction of membrane behaviour will also be presented.

Dr De Angelis is an Associate Professor who works on the experimental and theoretical analysis of fluid transport in solid materials, with applications in separation of gaseous and liquid mixtures with membrane and adsorption and in the development of barrier materials for packaging.

- **University of Edinburgh: Membrane permeation and modelling** [Prof Lev Sarkisov]

The Institute for Materials and Processes within the School of Engineering has a carbon capture group with expertise in the detailed investigation, modelling and optimization of next-generation separation processes based on adsorption and membrane systems. The presentation will consider how membrane materials are experimentally characterised, with particular focus on permeation measurements for both pure gases and mixtures; this will outline how the process conditions, such as temperature and pressure, impact on this regarding the NanoMEMC² project. Their molecular modelling and process simulation activities will then be outlined.

Prof Sarkisov is Professor and Chair in Molecular Thermodynamics at the University of Edinburgh. His research interests span molecular simulation of adsorption and diffusion in porous materials, carbon capture, multiscale approaches to process design and optimization.

- **Norges Teknisk-Naturvitenskapelige Universitet: Nanocellulose-based membranes for CO₂ separation applications** [Dr Luca Ansaloni]

NTNU is the main technical university in Norway. The internationally-recognised membrane group is involved with a variety of CO₂ capture projects investigating gas separation and membrane contactors for CO₂ separation applications. For NanoMEMC², the focus has been the development of nanocellulose-based CO₂-selective membranes. Firstly, nanocellulose fibres were embedded within hydrophilic and reactive polymers, aiming at increasing the selective feature of the pristine polymeric matrixes. Secondly, nanocellulose was blended with ionic liquids, targeting an improvement of CO₂ flux through the cellulosic membrane matrix with limited effects on their selective features. Both flat sheet and hollow fibre configurations have been investigated. The membrane characterization was not limited to the separation performance, but also to the water and gas uptake within the hybrid matrixes.

Dr Ansaloni got his PhD from the University of Bologna in 2014 and since 2015 is a postdoctoral fellow at the Department of Chemical Engineering of NTNU. He has been involved in the NanoMEMC² project since its early developing stage. His research interests focus on polymeric membrane for gas and vapour separation and membrane contactors.

- **University of Sheffield and UKCCSRC: Carbon capture activities and vision in the UK – Testing capture at a pilot-scale for carbon-intensive sectors** [Prof Mohamed Pourkashanian and Dr Muhammad Akram]

The UK Carbon Capture and Storage Research Centre (UKCCSRC) leads and co-ordinates a programme of underpinning research on all aspects of carbon capture and storage. The UKCCSRC Pilot-scale Advanced CO₂ Capture Technology (PACT) national specialist facilities are dedicated to the research and development of advanced fossil-fuel energy, bioenergy and carbon capture for power generation and industrial applications. The presentation will firstly outline the activities and vision for carbon capture in the UK (Prof Pourkashanian). Secondly, the key research conducted at PACT for NanoMEMC² will be described (Dr Akram). The facilities will be utilised for the extensive assessment and evaluation of the membrane test module and pilot system; the experimental conditions and the key performance indicators used to characterise performance will be considered.

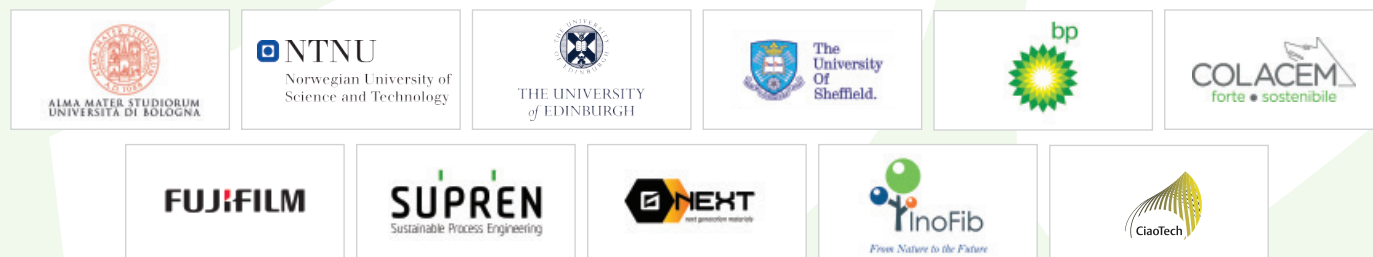
Prof Pourkashanian is the Director of the UKCCSRC national test facilities (PACT), Head of Energy2050 at the university and is a professor of energy engineering. His research is focused on clean energy technologies, with expertise in conventional power, CCUS, energy system simulations, bioenergy, AD, combustion, alternative fuels, CFD model development, energy policy and renewables. Dr Akram is a research fellow at Energy2050 and PACT, who works on a range of projects on carbon capture technologies from coal, natural gas, biomass and waste materials.

Interested in attending the event? Please register for free at:

<https://www.eventbrite.com/e/nanomaterials-enhanced-membranes-for-carbon-capture-nanomemc2-scientific-workshop-tickets-43341249845>

Would you have any questions about the event, please email Dr. Karen N. Finney at k.n.finney@sheffield.ac.uk

NANOMEMC² consortium



Nanomemc² is a project funded by the European Commission. This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement n° 727734