PROJECT TITLE: ELECTROOSMOTIC WATER CAPTURE WITH CARBON NITRIDE MEMBRANES

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Project keywords: carbon nitride membranes; water capture; solar energy; electroosmosis; irrigation and agriculture; resilience

Proposed start date: July 2023 (negotiable)

Project description
In recent work, we have been able to make carbon nitride materials from low-cost organic precursors and we have shown that these materials offer photo-disinfection reactivity as well as processibility into thin mechanically robust membranes. These membranes contain 2-3% water under ambient conditions and due to intrinsic microporosity, they allow flow of ions and small molecules such as water.

The coupled transport of ions and water is called electroosmosis and it can be very useful in converting electricity (from solar cells) into a water transport gradient. In this project we want to build prototype devices for proof-of-principle of solar-driven water transport. The scholar will explore membrane production and electrochemical investigation of properties. We will employ 3D-printing to make devices and show that solar electricity can be converted into increased humidity and ultimately condensation of water. If successful, this project will lead to further collaboration with civil engineers and to the development of precision agriculture methods to be used for agriculture in arid regions including regions in the UK.

The project combines materials synthesis, measurement of properties, prototype design and further testing. You are working under guidance of a PhD student and interact with researchers in the Water Institute. You are going to learn about methods including electrochemistry, electron microscopy, thermal gravimetry, and humidity measurement. For more information, please contact me (f.marken@bath.ac.uk).

Candidate requirements
A basic understanding of stream water-chemistry would help but is not essential. Training on any analytical equipment will be provided and the student will be supported throughout the project."