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Mineralisation Processes for CO_2 Storage

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Home Department: Department of Earth Science and Engineering

Funding and Deadline: To be eligible for support, applicants must be "UK Residents" as defined by the EPSRC. The studentship is for 3.5 years starting as soon as possible and will provide full coverage of standard tuition fees and an annual tax-free stipend of approximately £17,609. Funding is through the project InFUSE, funded by the EPSRC and Shell.

Please contact Sam Krevor (s.krevor@imperial.ac.uk) or any of the above listed supervisors if you are interested in applying for the position. Application submissions must be made through Imperial College at https://www.imperial.ac.uk/study/pg/apply/how-to-apply/apply-for-a-research-programme-/. Applications received before January 31st 2022 will receive the highest priority for consideration.

Project Description: The importance of carbon capture and storage in the mitigation of climate changes arises from the potential capacity for the injection of large volumes of CO_2 into suitable subsurface geologic formations, or the fixation of CO_2 into solid mineral carbonates. Fluid-rock interactions involving the dissolution or precipitation of solid minerals are central to the flow and trapping of CO_2. The reaction of CO_2 with mafic and ultramafic rock formations can lead to permanent sequestration in the form of carbonate minerals. Understanding of these processes has been limited, however, by difficulties in observing reaction progress *in situ* of the complex pore-structure of rocks in which they occur.

New laboratory experimental and X-ray imaging "Digital Rock" capabilities now permit the imaging of mineralogical and chemical properties of rock-fluid systems while undergoing reaction. The capabilities of the DIAD beamline at the Diamond Light Source Synchrotron open up new opportunities in the combined observation of reaction processes at high time resolution, their impact on pore morphology, the feedback into the hydrological properties of porous rocks, and ultimately, their role in controlling systems central to CO_2 storage. In this project the researcher will make use of these tools, combined with advanced image analysis techniques, to further our understanding of CO_2 mineralisation processes.

We welcome applications from candidates for October 2022 entry to join the multidisciplinary project InFUSE whose aim is to study key material and fluid interfaces across a range of application areas with direct impact on the energy transition. Examples of such systems include: geomaterials (for CO_2 and H_2 storage), energy materials (catalysis, batteries, materials for hydrogen); next generation lubricants and fluids (e-fluids). Our aim is to create a step-change in the correlative characterisation of interfaces embedded in these systems under realistic environments

Ideally, you will hold, or be expected to achieve, a Master's degree or a 4 year undergraduate degree at 2:1 level (or above) in a relevant subject, e.g. Material Science, Mechanical, or Chemical Engineering, Physics, Chemistry, Earth Sciences or a related discipline.

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Relevant references:

Krevor, S., Blunt, M. J., Trusler, J. P. M., & Simone, S. D. S. (2019). An introduction to subsurface CO_2 storage. *Carbon capture and storage*. (**https://doi.org/10.1039/9781788012744-00238**)

Lai, P., Moulton, K., & Krevor, S. (2015). Pore-scale heterogeneity in the mineral distribution and reactive surface area of porous rocks. *Chemical Geology*, *411*, 260-273.

Snæbjörnsdóttir, S. Ó., Sigfússon, B., Marieni, C., Goldberg, D., Gislason, S. R., & Oelkers, E. H. (2020). Carbon dioxide storage through mineral carbonation. *Nature Reviews Earth & Environment*, *1*(2), 90-102.