InterPore2023; 21 – 26 May 2023, Edinburgh, UK
Special Focus on Energy Transition

Confronted with the biggest and most difficult global challenge to mankind, efforts are intensifying to move away from fossil-based energy sources to zero-carbon energies. This transition to renewable energy resources and lowering of carbon dioxide emission to the atmosphere must happen at an unprecedented pace in order to have the desired effect. In this regard, urgent research in some major areas and technologies is needed. Many of these research questions are related to porous media phenomena.
Therefore, InterPore2023 will have a focus theme on Energy Transition. A leading expert in energy transition will give a plenary lecture, and then, during a lunch forum, a panel of experts will engage in a discussion with the participants regarding the current urgent research needs in various energy transition technologies and methodologies. Also, all participants who submit an abstract to InterPore2023 are asked to use the hashtag # Energy_Transition, if appropriate, such that we can highlight those contributions in the program.

H_2 – Storage

Improving current hydrogen storage capabilities is crucial for the advancement of hydrogen and fuel cell technologies (HFT), which are decisive for a carbon-emission-free future. Existing approaches either store H_2 physically as a gas (above 350 bar) or as a liquid (below −252.8°C), or by adsorption/absorption. While hydrogen provides the highest energy per mass of all fuels, its energy per volume is low. Therefore, storage methods for huge volumes have to be devised. Underground hydrogen storage in the subsurface (USPH), such as saline aquifers, depleted hydrocarbon reservoirs, and cavities in salt domes or crystalline rock formations, seems to have this potential, but this approach is not well developed or tested yet.

Thus, much more research is required in order to make large-scale commercial deployment of UHSP safe and efficient. Obviously, the Interpore community is in an optimal position to make a huge impact here, and therefore we strongly encourage abstract submissions related to hydrogen storage cycles including improved procedures and workflows, reservoir engineering, chemistry, geology, and microbiology.
Please use the hashtag # Energy_Transition.

CCS

Carbon capture and storage (CCS) is about capturing CO_2 before it gets into the atmosphere, its transportation, and its permanent storage (carbon sequestration). Typically CO2 gets captured from large point sources (e.g. from power plants or industrial sources). Among all storage methods, geological formations have the greatest potential to deal with huge volumes, which is crucial for a global impact. According to the US National Energy Technology Laboratory, the storage capacity of North America alone exceeds 900 years' worth of CO_2 at current production rate. Generally, geological underground storage involves CO_2 in supercritical form, and site candidates are oil and gas fields, un-mineable coal seams, and saline aquifers. While saline aquifers would provide the largest storage volume, they come with little direct economic incentive (unlike e.g. enhanced oil recovery). For the same reason, little investments are made for geophysical exploration of saline aquifers, and thus their aquifer structures are highly uncertain (unlike those of oil fields and coal beds).

Main problems of CCS are integrity and risk of CO_2 leakage into the atmosphere. Therefore, much further research related to the uncertainty of potential sites is required. Moreover, if one relies on structural trapping, reliable geomechanical models are required. Also, lab- and field-scale- experiments, pore-scale modeling, and multi-scale methods are required for a better understanding of residual, solubility, and mineral trapping. Here again, the Interpore community is in an optimal position to make a huge impact, and thus we strongly encourage abstract submissions related to CCS. Please use the hashtag # Energy_Transition.

Electrochemcial Energy Conversion Devices

Most of the hydrogen that is currently produced is based on steam-methane reforming processes. It is termed "grey hydrogen" due to CO_2 emission during its production process. However, the main target of countries that plan to reach climate agreement goals is green hydrogen. The production of green hydrogen is based on electrolyzers which split water molecules into hydrogen and oxygen. Commercially available electrolyzers (PEM, SOEC, etc.) are made of porous electrodes and water. Also, produced gases are transported through porous layers. While the electrolyzer uses electricity to produce hydrogen, electricity can be generated by a reverse process; such a device is called fuel cell and has very similar porous layers. Many open questions exist related to multiphase flow processes as well as transport of heat, solute, and charges in porous materials of electrochemical devices. The electrolysis process consumes large amounts of energy, and it is essential to find new ways of producing water from hydrogen that are more energy efficient. Such methods inevitably will involve porous media and complex flow and transport processes, and they require dedicated research.

We invite participants of InterPore2023 to submit contributions related to the current H_2 production and consumption methodologies as well as innovative and novel approaches. Please use the hashtag # Energy_Transition.