



Editorial to the Special Issue: Adsorption, Absorption and Thermochemical Transport Processes in Complex Porous Structures

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Abstract

The theme of coupling problems for adsorption, absorption and thermochemical transport in porous media is very important for engineering applications. Based on the submissions to the mini-symposium 22 of InterPore 2020, this special issue used this opportunity to evaluate some of these papers, and also invite some other scholars to submit their latest original research findings which are either advances in the state of the art of numerical models, molecular studies or experimental studies for new contributions. All the submissions developed existing models or methods and showed the critical engineering problems in ‘Adsorption, Absorption and Thermochemical Transport Processes in Complex Porous Structures’ to be presented in the journal *Transport in Porous Media*.

Keywords Porous media · Adsorption · Absorption · Thermochemical transport · Heat and mass transfer

Porous media refer to a special kind of solid materials with pore spaces distributed continuously on the macroscopic level (randomly on the microscopic level) and have a very wide range of applications in all walks of life. Therefore, this special issue, involving the term ‘Complex Porous Structures,’ paid a special attention to various aspects of fluid dynamic, heat and mass transfer as well as adsorption/absorption generally. Adsorption, absorption and the related thermochemical transport processes porous media are very important

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and can find considerable applications in engineering, such as refrigeration, heat storage, CCUS (carbon capture, utilization and storage), chemical engineering and so on. Nearly all the above processes have an inherent coupling relationship between the porous material in the solid state and the fluid in the pore space. There is great potential for research in various aspects for the coupling of porous solid and fluid related to adsorption, absorption and thermochemical processes, such as fluid flow, heat and mass transfer, chemical reaction mechanisms, multi-scale models and algorithms, experimental data, and molecular dynamics study, with various applications.

This special issue began to receive submissions from October 7th, 2020 to January 11th, 2021. In response to the call for papers, a total of the seventeen papers were submitted for possible publication. Finally, twelve papers met the acceptance criteria for final publication after the rigorous peer review process. The other five submissions may have been technically correct, but were not considered appropriate for either the novelty or the scope of this special issue. The authors of paper submissions involve scholars from all over the world such as China, USA, France and Brazil. This shows the wide influence of the selected topic and the effective organization of the guest editorial team of this special issue. We hope that while solving some of the current difficulties, this special issue of the journal can also provide colleagues in the scientific community with the latest scientific results and research ideas.

The research content of the papers of this special issue includes a molecular dynamics study of water flooding in an oil–water system (Sun et al. 2020), reconstruction of porous structures (Gao et al. 2020), thermochemical heat storage (Wang et al. 2020), pore scale models for immiscible displacement (Zhang et al. 2021a), MOFs (metal–organic frameworks) screening for hydrogen storage (Wang et al. 2021a), lattice Boltzmann, LB, algorithms for interactions between fluid flow and deformable porous media (Mou and Chen 2021), adsorption characteristics of CO₂ to enhance recovery of shale gas CH₄ (Yang et al. 2021), multiple retention mechanisms for transport in porous media (de Oliveira Rios Filho et al. 2021), solid–fluid molecular interactions on nanoconfined fluid flow (Wang et al. 2021b), liquid transport in nanoscale porous media (Zhang et al. 2021b), effective porosity and dispersion coefficient from core flooding (Guibert et al. 2021) and numerical modeling of gasification of porous char particles in supercritical water (Fan et al. 2021). It can be seen that the accepted papers describe novel and rigorous research in the subject areas of the special issue.

This special issue introduced novel mesoporous or nanoporous materials, with advances in numerical, theoretical and experimental methods with various applications. It is also shown that molecular dynamics simulations are a promising direction for exploring microfluidic or nanofluidic characteristics in porous structures. Efficient multi-scale models for describing processes over a range of spatial and temporal scales are now being developed to understand the complex multi-physics coupling of flow, heat and mass transfer, and chemical processes at different scales. The mechanisms for modeling and interpreting chemical reactions and reactive flows in porous structures are undergoing rapid development. In general, there is potential for the subject of adsorption, absorption and thermochemical processes in various complex porous structures to grow rapidly through research with application to a wide range of engineering applications. We sincerely hope that this special issue will not only provide the scientific community with the latest progress and research overview in this field, but also prove of interest to those interested in specific applications.

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