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Preface to the Special Issue: Interfacial Phenomena in Multiphase Systems at Pore Scale

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Porous materials have high specific surface area and complicated morphology, which dramatically amplifies interfacially driven processes leading to complex transport behaviors. Over the past decade, significant improvements in experimental and computational tools have enabled the direct probing of pore-scale physics. Numerous findings have been reported that provide new insights on how interfacial phenomena modulate Darcy-scale fluid behaviors.

Despite such advances, much remains to be learned about the rich interfacial physics of multiphase systems. In 2020, we organized a mini-symposium (MS-6) at the InterPore conference titled *Interfacial Phenomena in Multiphase Systems at Pore Scale*. The high-quality contributions and stimulating discussions ensuing the mini-symposium inspired us to put together a special issue on the same title in *Transport in Porous Media*. Our goal was to encourage submissions that explored integrated approaches for bridging pore- and Darcy-scale processes based on a deeper understanding of interfaces in porous media.

As such, we received 17 papers that were peer-reviewed and accepted for publication. The leading paper of this special issue is a comprehensive review of the different capillary number definitions as well as recent approaches on capillary desaturation curve (CDC), which are two of the most fundamental concepts in multiphase flow in porous media. The second review paper is on a recently popular topic "dynamic capillary effect". We believe these two review papers capture the core focus of this special issue.

Following these review papers, the special issue consists of a collection of 15 articles covering:

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(1) Behavior of dispersed fluids (e.g., bubbles, droplets, foam) at the pore scale
(2) Evolving interfaces due to fluid–fluid displacements at the pore scale
(3) Multiphase interfacial phenomena and hydrodynamics in nanoporous materials
(4) Upscaling of complex interfacial effects from pore to Darcy scale

The special issue is meant to provide an overview of recent advances in our understanding of interfacial phenomena at the pore scale and how they affect Darcy-scale observables. We greatly appreciate the encouragement and support of the Editor-in-Chief, Prof. Martin Blunt, and the editorial team of *Transport in Porous Media*. We are also very grateful for the time, effort, and constructive feedback provided by the many reviewers who helped bring this lengthy effort to completion.