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**PROCEEDINGS**

# Key Transport Mechanisms in Supercritical $CO_2$ Based Pilot Micromodels Subjected to Bottom Heat and Mass Diffusion

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## ABSTRACT

The ambiguous dynamics associated with heat and mass transfer of invading carbon dioxide in sub-critical and supercritical states, as well as the response of pore-scale resident fluids, play a key role in understanding $CO_2$ capture and storage (CCUS) and the corresponding phase equilibrium mechanisms. To this end, this paper reveals the transport mechanisms of invading supercritical carbon dioxide ($sCO_2$) in polluted micromodels using a variant of Lattice-Boltzmann Color Fluid model and descriptive experimental data. The breakthrough time is evaluated by characterizing the displacement velocity, the capillary to pressure-difference ratio, and the transient heat and mass diffusion at a series of micromodels with scaling pore-throats. Wet micromodels are also processed to establish a reference database towards a natural extension to saline aquifers. The prime recorded sub-regimes are remarkably categorized as oscillatory while the interfacial velocity of $sCO_2$/pollutant is jumping into oscillatory magnitudes. The transient saturation of $sCO_2$ would be significantly accelerated with decreasing pore-throats, demonstrating increased invasion efficiency. Accordingly, a special model would be established to account for the transport mechanisms of invading $sCO_2$ towards efficient geological sequestration.

## KEYWORDS

Pore-scale transport; supercritical $CO_2$; multiphase LBM, heat-mass transfer, carbon capture and storage

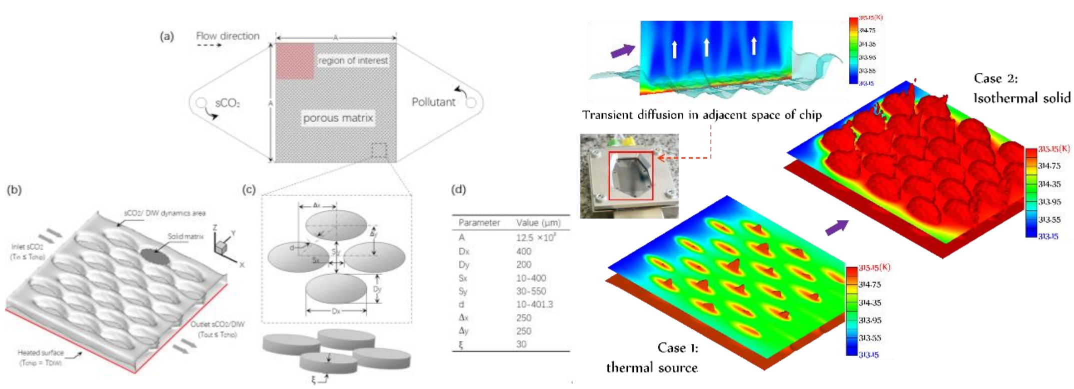


**Figure 1:** Target micromodel with geometric boundaries, and transient sketch of heat transfer from inside the solid media to the pore-throats.

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