Contribution ID: **622** Type: **Oral Presentation**

An Integral Model of Gas Diffusion, Sorption, and CO2 sequestration in Tight Dual-Porosity Organic-Rich Systems

Wednesday, 21 May 2025 11:50 (15 minutes)

To optimize shale gas recovery during production operations and subsequent CO2 storage in depleted shale plays, it is essential to accurately represent all transport and storage mechanisms involved. These include viscous flow, transitional flow, Knudsen diffusion, surface diffusion, and sorption. Despite extensive efforts in technical literature, comprehensive modeling of transport and sorption in fractured shale remains a major challenge.

In our previous research, we introduced a multi-porosity model based on the assumption that the characteristic time for sorption is greatly larger than the characteristic time for transport. Building on that foundation, this study introduces a general dual-porosity model for cores-scale interpretation of gas transport and sorption in organic-rich shales. The new formulation was developed to accommodate gases exhibiting a broad range of sorption affinities and extends the applicability of Vermeulen's generalized modeling approach to a broad range of characteristic times for sorption.

To validate the proposed model, we compare calculation results with fully discretized numerical solutions for inert gases (helium - He) and highly adsorbing gases (i.e., carbon dioxide –CO2). The comparison demonstrates that the new model provides for accurate representation of gas transport and sorption in dual-porosity systems without the need for full domain discretization. Furthermore, we demonstrate how the new model can be applied to characterize transport and storage in shale cores based on tandem experiments with He and CO2.

In summary, a novel integral model for transport and sorption in dual-porosity systems is developed and validated. The model is demonstrated to provide an efficient tool for interpretation of core-scale experiments while also offering a path for upscaling transport and sorption via translation of relevant characteristic times.

Country

United States

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

Water & Porous Media Focused Abstracts

References

Primary authors: LYU, Ye (University of Southern California); JESSEN, Kristian (USC)

Presenter: LYU, Ye (University of Southern California)

Session Classification: MS01

Track Classification: (MS01) Porous Media for a Green World: Energy & Climate