Tracer Gas Diffusion in the Eagle Ford Shale, Austin Chalk, and Adjunct Vertical Formations in Southwestern Texas

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Abstract

As one of the two critical transport mechanisms in shale gas reservoirs, gas diffusion can be quantified by the diffusion coefficient (m^2/s) within the shale matrix. To understand the diffusion behavior in rock matrices, 1-D short-duration (within 24 hours) tracer gas diffusion chamber tests at room temperature were conducted on the major reservoirs (Eagle Ford Shale and Austin Chalk), and adjunct vertical formations (Atoc Chalk, Buda Limestone, Del Rio Formation, and Salmon Peak Limestone) in the Southwestern Texas area. Associated with X-ray diffraction, thin section, liquid immersion porosimetry, mercury intrusion porosimetry, and spontaneous imbibition, the mineral composition, permeability, pore structure (both geometry and connectivity) were taken into the discussion of influencing factors. The results of gas diffusion tests show that the diffusion coefficients among these rocks with different lithologies vary in the magnitude of 10-7 to 10-6 m^2/sand is influenced by pore structure especially pore connectivity.

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