Permeability in Shales

Michael Cronin, The University of Texas at Austin

ABSTRACT

In shale matrix, the presence of nanopores ($r < 10^{-7}$ m) suggests that matrix permeability to gas will be strongly pressure and pore-size dependent due to the combined effects of gas-slip, Knudsen diffusion, and advection. I introduce a simple pore network model describing shale matrix as a bundle of parallel tubes to investigate the relationship between pore network architecture and gas transport. Next, I propose that the pulse transient decay permeability method will provide a fundamental data set to invert observed transport behavior for pore network structure. Future work will attempt to build predictive pore network models at the core-scale.

CLICK ON IMAGE FOR LARGER VIEW

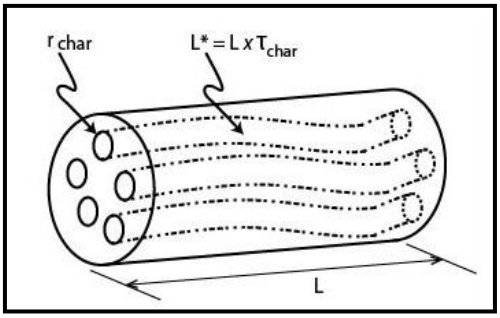

Fig. 1: Conceptual model of pore network as bundle of nanopore tubes with experimentally determined parameters for equivalent radius and tortuosity.

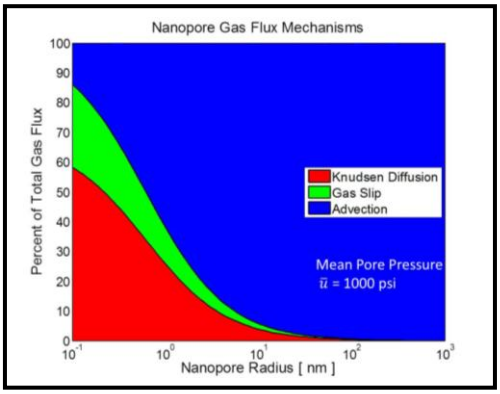

Fig. 2: Area plot comparing the relative contribution of three transport mechanisms in nanopores: Knudsen diffusion, gas slip, and advection (% of total gas flux) *vs.* nanopore radius in nanometers. Plot generated for N_2 using the nanopore gas velocity model proposed by Javadpour (2009).

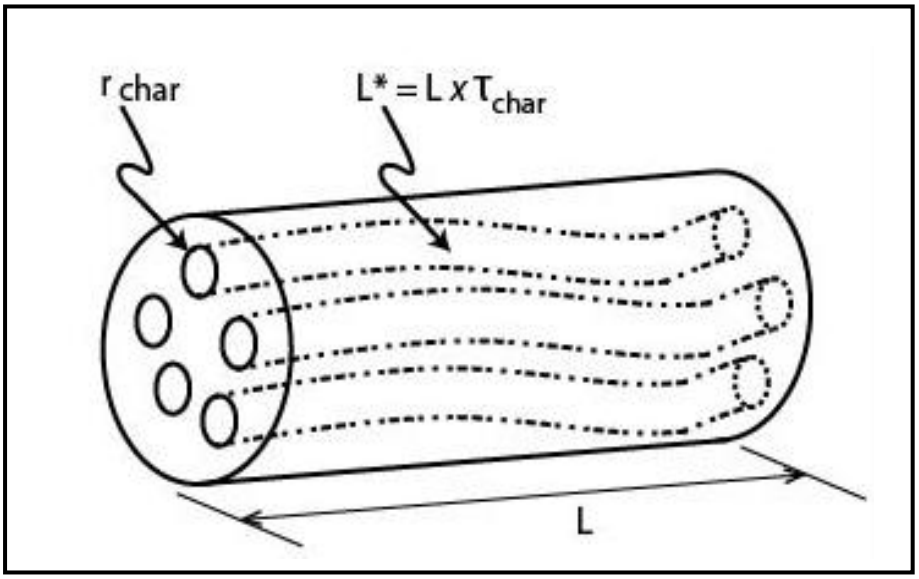

Fig. 1: Conceptual model of pore network as bundle of nanopore tubes with experimentally determined parameters for equivalent radius and tortuosity.

Back

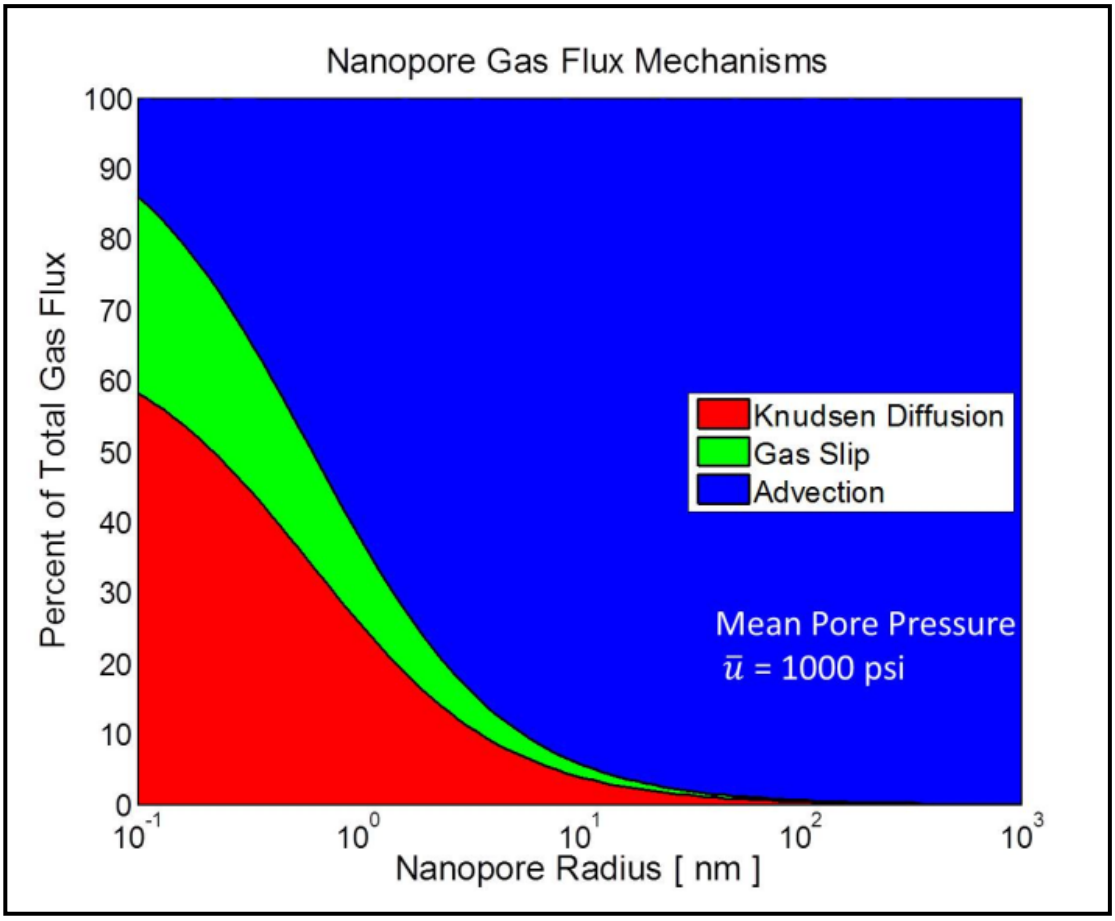

Fig. 2: Area plot comparing the relative contribution of three transport mechanisms in nanopores: Knudsen diffusion, gas slip, and advection (% of total gas flux) *vs.* nanopore radius in nanometers. Plot generated for N_2 using the nanopore gas velocity model proposed by Javadpour (2009).

Back