Contribution ID: **963** Type: **Poster**

Universal Scaling Relation for Kinkenberg Flows in Nanoporous Media

Wednesday 16 May 2018 17:15 (1h 30m)

In this study, slip flow of gases were measured in several tight reservoir rock samples and nanofluidic chips. The results were then compared to gas flow simulations by DSBGK. Klinkenberg permeability of rocks was obtained using a steady-state method under varying pore pressures but constant temperature and effective stress. Experiments conducted in nanofluidics devices, which have controlled pore size, also used the steady-state method. Same gas was used in both experiments, making them directly comparable. Independent DSBGK simulations were carried out on several constructed geometry models. The Klinkenberg factors obtained from these independent studies varied across three orders of magnitude, yet they all collapse on a single scaling relation that indicates that the Klinkenberg factor is inversely proportional to the square root of the intrinsic permeability.

References

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Authors: Mr YU, Xiangyu (Colorado School of Mines); Mr TIAN, Ye (Colorado School of Mines); LI, Jun (King Fahd University of Petroleum and Minerals); Prof. YIN, Xiaolong (Colorado School of Mines); Mr NEEVES, Keith B. (Colorado School of Mines); WU, Yu-Shu (Colorado School of Mines)

Presenter: Prof. YIN, Xiaolong (Colorado School of Mines)

Session Classification: Poster 3

Track Classification: MS 1.24: Pore structure characterization and micro-scale effect on fluid flow in unconventional reservoir