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# The characteristics of the gas and water flow through the microtubes and nanotubes

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The nanoscale flow characteristics are studied more and more popular recently, especially on the development of shale gas reservoir, and gas transport mechanisms include continuous flow, slip flow, and transition flow, which are complicated problems to study. Herein, experiments on deionized water and gas flow through micro-tubes and nanotubes with diameter of 16μm, 6μm, 124nm and 67nm are carried out to research flow characteristics at nanoscale porous media, respectively.

The experimental results of water flow through microtubes and nanotubes are shown in Figure 1, which shows that the Hagen-Poiseuille equation is valid when the micro-tubes diameter is 16μm, and the experimental flux reduces slightly when the diameter decreases to 6μm.
However, the flux of water through nanotubes are even less than the H-P equation by one order of magnitude, and deviations between the experimental flux and the theoretical flux tremendously increase with the decrease of diameters of nanotubes.

Figure 1 Comparison of experimental water flux and Hagen–Poiseuille flux

The experimental results of gas flow through microtubes and nanotubes are shown in Figure 2, which shows that when gas flows through the microtubes with a diameter of 16μm, the experimental flux agrees well with the H–P equation, while the experimental flux slightly increases when the diameter decreases to 6μm. However, the deviations between the experimental flux and the theoretical flux will tremendously increase with the decrease in the diameters of nanotubes from124nm to 67nm. Small nanotube diameters lead to high deviations between the experimental flux and the H–P equation. The flux of the gas flow through the nanotubes is even higher than the H–P equation by one to two orders of magnitude, and the H-P equation considerably underestimates the gas flux at nanoscale.

Figure 2 Comparison of experimental gas flux and Hagen–Poiseuille flux

KEYWORDS：microtubes, nanotubes, shale gas, water, H-P equation

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## References

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