conferenceseries.com

J Aeronaut Aerospace Eng 2018, Volume 7
DOI: 10.4172/2168-9792-C2-026

6th International Conference on

Aerospace and Aerodynamics

August 02-03, 2018 | Barcelona, Spain

Rarefied gas dynamics in nano-carbon tubes

Ebrahim Fathi, Nupur Gupta and **Fatemeh Belyadi**
West Virginia University, USA

Advanced imaging technologies such as FIB/SEM and low temperature adsorption measurements show that in the shale gas reservoirs, kerogen, the finely dispersed organic nano-porous material with an average pore size of less than 10 nm holds bulk of the total gas in place. The molecular level interactions between fluid-fluid and fluid-solid organic pore walls govern the transport and storage in these organic nano-pores. Among different methods used to model gas dynamics in organic nano-pores the Lattice Boltzmann Method (LBM) is more effective method with much less computational cost. In this study a new LBM model with Langmuir-slip boundary condition at capillary walls, convection flow and diffusive transport are considered. Different transport mechanisms and their contribution in gas transport is investigated in a large range of Knudsen numbers. The deviation from classical theory of fluid flow in micro channels such as Knudsen's minimum in the mass flow rate is investigated and the effect of gas slippage and double slippage on Knudsen minimum is discussed in details. Finally the results are compared with analytical, and semi analytical solutions available in the literature. The LBM model results displays clear indication that the gas transport in the capillary tube is highly depends on the pore width size, pressure and temperature. A critical Knudsen number exists at different reservoir conditions, where the anticipated parabolic fluid velocity profile in organic nano-pores alters and shows higher flow rate as capillary widths reduces due to the underlying effect of molecular phenomena of double slippage and the wall confinement.

Ebrahim.Fathi@mail.wvu.edu

Notes: