Mesoscale Priority Research Direction

Characterization of tight gas reservoir pore structure

Opportunity

Development of unconventional, onshore natural gas resources in deep shales is rapidly expanding to meet global energy needs. Accurate information on the pore structure of tight gas shales is required to better understand the gas storage and transport mechanisms that, in turn, have direct implications for gas producibility

Meso Challenge

The pore structure of unconventional gas reservoirs (tight gas, shale gas and coalbed methane) is difficult to characterize because of the ultra-fine (nano- and mesopore) structure, often associated with organic matter content, and generally broad pore size distribution. Understanding the nature of the pore structure, evaluation of the open versus closed porosity is a primary objective leading to a better understanding of the enhanced methane recovery.

References: CR Clarkson, et al., Fuel (2012).

Approach

A hybrid of techniques is typically required to investigate the full pore size spectrum in shales, including a combination of fluid invasion and radiation methods. Small Angle Neutron Scattering provides a unique opportunity to assess amount of both open and closed pores in geological formations. Recently developed method of evaluation of the volume of pores inaccessible to fluids under pressure provides information inaccessible to the "traditional" methods such as helium porosimetry, low-pressure N_2 and CO_2 adsorption isotherms as well as gravimetric and volumetric measurements.

Impact

Shale gas and gas hydrates show immense potential for both hydrocarbon (methane) production, to serve as a transition fuel, and sequestration of carbon dioxide. Ideally, CH_4 can be "exchanged" for CO_2 in both systems to allow for simultaneous incremental recovery of hydrocarbons and CO_2 storage. This research will provide protocols for screening shale and gas hydrate reservoirs with methane production and CO_2 sequestration potential.

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