Contribution ID: **467** Type: **Oral Presentation**

Acute observations into multifractal characteristics of bituminous coals by Qualitative analytics

Monday, 30 May 2022 17:35 (15 minutes)

Adopting FESEM and AFM imaging technology, a concatenation of 2-D and 3-D nano-scale investigations are comported on the types of pore-cleat constituents inherent to CBM and CO2-ECBM producibility. A finely dispersed mineral material is ascertained within the organic coal matrix. The latter may influence the differing pore geometries and capillaries featuring characteristic lengths varying from nanometers to microns. A significant portion of gas producibility appears to be associated with these inter-connected large scale nanopores within the matrix. This investigation finds its implications on optimal producibility of CBM and CO2-ECBM processes. Thermodynamics of fluid-rock interactions in these pores are very diverse. Gas transportation in these conduits is rarefied due to the mineral phase pore walls and indicate a tendency of density profile across the damped oscillations. This arises the complications about the gas producibility predictions, under the insitu conditions, the fraction of gas considered to be as adsorbed phase and accurate estimation of gas adsorption capacity by the use of volumetric measurements. Also, density contrast between the adsorbed/free phase in mineral material for accurate gas producibility.

To emphasize on these complications associated with gas transportation, we attempted to integrate the volumetrics of adsorbed/free gas phases with multifractal characteristics of a high proliferous bituminous coal. The outcomes of the investigations yield a gas producibility because of corrected pore volumetrics that is affected as a result of average adsorbed/ free gas density. In addition, we address the complications associated with the thermodynamic phase transitions of gas in mineral conduits using dynamic simulations engrossing gas transportation in ink-bottle neck pores of diverse diameters. Investigations indicate that the gas density profiles across these pores reveal that density of adsorbed phase is 1.85 –2.5 times lower than that of the bulk methane considering only molecular diffusion constraints. These investigations create a new paradigm in a pore volumetric adjustment in particular to gas transportation in bituminous coals. At an outset, employing the typical parametric values, we repeated the evaluation for various bituminous samples and asserted that 16-20% decrease in the estimation of adsorbed/free gas sorption by volumetric measurements. A significant proportion of mineral material is abstracted by the adorbed phase which is proved with multifractal characteristics of coal pore geometries and capillaries which is disregarded in sorbed volume consumption, unintentionally overestimating the gas producibility. This methodology can be adopted for evaluating the unconventional resource producibility for various basins in compliance to CBM and CO2-ECBM processes.

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Participation

In person

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Session Classification: MS17

Track Classification: (MS17) Thermal Processes, Thermal Coupling and Thermal Properties of Porous Media: modeling and experiments at different scales