148ad Gas Hydrate Equilibria in Porous Media with Pore Size Distributions

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Gas hydrates are crystalline solids formed from mixtures of water and low molecular weight gases. Naturally occurring gas hydrate represents a potential natural gas reserve and the research of methane gas hydrate in the sediments has been addressed. Since the equilibrium condition of gas hydrates in the sediment is much different than that in bulk water phase, different thermodynamic model is needed for the hydrates equilibrium in the sediment. More accurate prediction of gas hydrate formation in the sediment has been achieved using variable contact angles between water and gas in pores (Peddireddy et al., 2005). Contact angles in various pores were calculated using an empirical correlation and this method can reduce the error for the prediction of gas hydrate equilibrium pressure over 50% compare to the Mathew-Bishnoi model in the temperature over 274K. In this presentation, a new model is proposed by incorporating pore size distribution into the variable contact angle model. Pore size density will be expressed in terms of Gaussian normal distribution. Different water enthalpies will be calculated according to the fractional volume of ice or water. This new model can be applied for the prediction of gas hydrate equilibria in the sediment with different pore size distributions and different fractions of water and ice.

Reference: S. Peddireddy, J.W. Lee, and S.Y. Lee, “Thermodynamic Model for Gas Hydrate Equilibrium in Porous Media,” provisionally accepted to AIChE J. (May, 2005).