Modeling of Gas Hydrate Equilibrium Conditions in Porous Media

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ABSTRACT

Recent years, more interests are attracted to gas hydrate regarded as potential energy resources of the future. A giant amount of natural gas exists onshore buried under the permafrost and offshore under the oceanic or deep lake sediments as natural gas hydrates. The intention of producing natural gas from these reservoirs has stimulated interests in the study of gas hydrate formation/decomposition in porous media. It is known that the sediments inhibit hydrate formation and change the stability condition. The pore size of porous medium affects greatly the formation and dissociation conditions of the gas hydrates and the thermodynamic properties. In addition, many porous materials have broad pore-size distributions. Thereby, the study of hydrate formation/dissociation is much more complex for porous media than for the bulk. In this study, the Chen-Guo hydrate model was extended to the predictions of hydrate formation conditions in porous media. The interfacial tension between hydrate and water is regarded as the function of temperature and pore size. The influence of the pore-size distribution was introduced into the calculation. The thermodynamic model proposed in this study were tested by extensive experimental data. Clark et al. (1999) proposed a model for calculating hydrate equilibria in porous media are based on the van der Waals–Platteeuw model combined with Gibbs-Thomson relationship to determine the interfacial tension between hydrate and water from experimental data. Clark et al. (1999) proposed a model for calculating the hydrate equilibrium dissociation conditions in the porous media by adding a correction term to the bulk hydrate model developed by van der Waals and Platteeuw (1959) to account for the capillary effect. Because of the large deviations of predictions from experimental data, Wilder et al. (2001), Klauda and Sandler (2001) and Smith et al. (2002) proposed the calculation methods with considering the distributions of pore-size.