Predictions of Gas Hydrate Phase Equilibria in Natural Sediment Porous Media

by

Jeffery B. Klauda and Stanley I. Sandler*

An accurate prediction for the thickness of hydrate stability zones in the seafloor and permafrost regions is necessary for a number of reasons, including estimating their methane content. Here we present a model that accurately predicts the maximum depth of hydrate stability in the seafloor and permafrost regions that includes the effects of water salinity and of hydrate confinement in pores, in which we take into account the distribution of pore sizes in sediments. This model uses soil type, geothermal gradient, and seafloor or permafrost depth as inputs, and leads to predictions of the maximum depth of hydrate stability for data collected in the Ocean Drilling Program (ODP) with an average error of less than 5%. Using this, we have also developed a model for the global distribution of methane in environmental hydrates, and estimate that there may be 49·10$^{15}$ m$^3$ of methane gas (expanded to atmospheric conditions) in ocean hydrates.

Keywords
Gas Hydrates, Clathrates, Porous Media, Permafrost, Ocean Hydrates

Department of Chemical Engineering, Center for Molecular and Engineering Thermodynamics, University of Delaware, Newark, Delaware, 19716, USA

*To whom correspondence should be addressed. Email: sandler@udel.edu. Phone: (302) 831-2945 Fax: (302) 831-4466.