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Impacts of hydrate saturation on water retention curve of hydrate-bearing sediments

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ABSTRACT

The experimental measurement of water retention curve in hydrate-bearing sediments is critically important to understand the behaviour of hydrate dissociation and gas production. In this study, tetrahydrofuran (THF) is selected as hydrate former. The pore habit of THF hydrates is investigated by visual observation in a transparent micromodel. It is confirmed that THF hydrates are not wetting phase on the quartz surface of the micromodel, and occupy either an entire pore or part of pore space resulting in change in pore size distribution. And the measurement of water retention curves in THF hydrate-bearing sediments with hydrate saturation ranging from S_h=0 to S_h=0.7 is conducted for excess water condition. The experimental results show that the gas entry pressure and the capillary pressure increase with increasing hydrate saturation. Based on the experimental results, fitting parameters for van Genuchten equation are suggested for different hydrate saturation conditions.

1. INTRODUCTION

The water retention curve (WRC) describes the amount of water retained in sediments at a given capillary pressure. Expression for capillary pressure as a function of water saturation requires multiple fitting parameters. Several analytical models have been proposed to describe the water retention curve [*Brooks and Corey*, 1964; *Corey*, 1954; *Fredlund and Xing*, 1994; *van Genuchten*, 1980]. Among them, *van Genuchten* [1980] model is widely used for various sediment types in many other gas hydrate simulation studies [*Anderson et al.*, 2011; *Gamwo and Liu*, 2010; *Moridis and Sloan*, 2007; *Moridis and Reagan*, 2007; *Reagan and Moridis*, 2008; *Reagan et al.*, 2010; *Rutqvist and Moridis*, 2007; *Wilder et al.*, 2008]:

$$P_c=P_0\left[\left(\frac{S_w-S_{rw}}{1-S_{rw}}\right)^{-\frac{1}{m}}-1\right]^{1-m} \qquad \text{Water retention curve} \qquad (1)$$

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