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The Dissociation Rate Measurement for Natural Gas Recovery From Gas Hydrates

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Abstract

Hydrate self-preservation property has been reported by some researchers in recent years. So as to test the dissociation rate of hydrates in different temperatures and pressure conditions. The authors conducted laboratory experiments of methane hydrate dissociation in order to examine its potential for application to product natural gas from hydrate. The gas methane's used in this work were artificially prepared using the methane hydrate. Methane hydrate dissociation was measured at atmosphere pressure within temperature range between -7ºC and 5ºC, and relatively slow dissociation was confirmed at around -5ºC. The dissociation rates of the gas hydrates observed can be used to evaluate the gas quantitatively of the hydrate fields, and to safely and eeconomically produce natural gas from hydrates deposits.

Key words: gas hydrates dissociation rate experimental text gas recovery

1. Introduction

Gas hydrates are ice-like crystalline materials that contain water and gases with small molecules, which were first observed in the laboratory in 1810 (Chatti, 2005). It was not until nearly 150 years later that they were observed in nature (Link, 2003). Gas hydrates are inclusion compounds composed of water cages that trap guest molecules. It is estimated that over 99% of the guest content is methane (Tulk, 1999). Gas hydrate can form naturally on Earth or as a result of made conditions. Naturally occurring gas hydrate in sediments (permafrost regions and subsea sediments) can be a potential natural gas resource. Natural gas hydrates offer a largely unexploited means of energy recovery and transportation and they could play a significant role in past and future climate changes (Sloan, 2003). One volume of hydrate could release 150 to 180 volumes natural gas at standard conditions (Collett, 1998). Current estimates of the worldwide quantity of hydrocarbon gas hydrates range between 10^{15} to 10^{18} m^3. Even the most conservative estimates of the total quantity of gas in hydrates may surpass by a factor of two the energy content of the total fuel fossil reserves recoverable by conventional methods (Collett, 2001; Solan, 1998). Thus, developing methods for commercial production of natural gas from hydrates has enormous economical and strategic importance (Ji, 2003).

In a recent paper discussing the estimates of worldwide gas hydrate resources, it was argued that there was still no clear cut convergence of estimates over the last twenty years and that the number of estimates is so small that serious doubt can be raised about the inferences drawn from the estimates (Lerche, 2001; Thomas, 2001). Despite the enormous range in reported gas hydrate volumetric estimates, even the lowest estimates seem to indicate that gas hydrates are a greater resource of natural gas than conventional accumulations. The magnitude of this resource could make hydrate reservoirs a substantial future energy resource. While current economic realities do not favor gas production from the hydrate accumulations, their potential clearly demands evaluation. It is important to note, however, than none of these assessments have predicted how much gas compound actually be produced from the world's gas hydrate accumulations. Much more work is needed to go beyond these in-place gas hydrates volumetric to assess the hydrates as an energy resource.

Gas recovery from hydrates is challenging because the gas is in a solid form, and because hydrates are widely dispersed in hostile Arctic and deep marine environments. Similar to conventional hydrocarbon production, the first recovery of hydrate resources will occur in areas with the greatest concentration. Proposed methods of gas recovery