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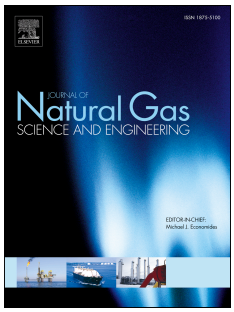

Monitoring gas hydrate formation and transport in a flow loop with acoustic emission

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Monitoring gas hydrate formation and transport in a flow loop with acoustic emission

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ABSTRACT

Experimental studies on flow loop allow estimating the amount of formed hydrate and their transport during time. The amount of hydrates formed spatially during flow is unknown together with the location of the beginning of sedimentation and plug. This experimental study was carried on to verify the use of acoustic emission (AE) to spatially follow the formation of hydrates but also sedimentation and agglomeration. The AE energy variations allowed to follow the emulsification, to identify the beginning of the crystallization and to follow the crystallization, agglomeration and plug/sedimentation in the flow loop.

KEYWORDS: acoustic emission, gas hydrates, crystallization, liquid-liquid dispersion, rheology, agglomeration

1. INTRODUCTION

The flow assurance domain concerns different types of technology used to ensure flow at onshore and offshore pipelines. Pipeline flow is altered by presence of different types of solids (wax, scale, hydrates…). Specifically concerning hydrates, their formation can slow down and even completely stop the flow in the pipeline [Sloan et al., 2011].

In order to prevent the stop of the flow and subsequent losses on production; several mitigation measures can be envisaged. The oldest ones are pipe thermal insulation and injection of methanol to displace the formation conditions into more severe ones. The high cost of these solutions leads the researchers to search new solutions. The recent measures include the use of low dosage hydrate inhibitors like anti-agglomerant and kinetic inhibitors. These will, respectively, prevent agglomeration between hydrates and slow down or prevent completely their formation. Another solution is cold flow, it consists without injection of any chemical on allowing formation of hydrate particles which are transportable as a slurry and do not deposit or agglomerate [Sintef, 2010]. Several researchers are studying associations between these mitigation procedures.

Gas hydrates are composed by water molecules connected through hydrogen bridges forming a cage that accommodates a gas molecule [Sloan, Koh, 2007]. In this study, the focus will be on methane hydrates.

The methane hydrates crystallization can be carried on a batch reactor, a cell or a flow loop [Sloan, Koh, 2007]. Experiments on flow loop allow the study of the crystallization under flow followed by the study of the slurry transport [Melchuna et al., 2016]. Hydrate formation in flow loops are closer to real field conditions. Although, as well as it happens in field scale, a major issue is monitoring the processes along the pipeline during time. This paper presents a preliminary study with a non-intrusive technique, acoustic emission (AE) technology, which allows to follow hydrate formation in pipelines.

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