

Study on the Mechanical Properties of the Tetrahydrofuran Hydrate Deposit

Lu Xiaobing¹ Wang Li¹ Wang Shuyun¹ Li Qingping²

¹Institute of Mechanics, China Academy of Science, Beijing, China

²Research Centre, China Ocean Oil Co., Beijing, China

ABSTRACT

Pure tetrahydrofuran hydrate and tetrahydrofuran hydrate deposits with different materials as the skeleton are synthesized in our laboratory. A series of experiments are carried out to study the mechanical properties. The stress-strain curve, strength of pure tetrahydrofuran hydrate and hydrate deposit are obtained. Some phenomenon is explained.

KEYWORDS: Tetrahydrofuran hydrate, mechanical properties, strength.

INTRODUCTION

Natural gas hydrate, or clathrate hydrate, a crystalline solid composed of natural gas and hydrogen bonded water molecules, is formed at relatively high pressure and low temperature conditions. Natural gas hydrate is extensively distributed in oceans, continental margins and some lakes. Because of the large volumes trapped in shallow sediments, natural gas hydrate is a potential source of energy, submarine geologic hazards and a factor in global climate change (Winters et al., 2007; Kvenvolden, 1988; briaud and Chaouch, 1997; Chaouch and briaud, 1997).

Properties of the porous host sediment affect the morphology and extent of hydrate growth, which in turn alters the host sediment properties (Lee and Collett, 2001).

In recent years, gas hydrate has become of great interest to the scientific community for the following reasons (Clayton, 2005):

1 It is conservatively estimated that more than 50% of the 18.8 Tt (terratonnes) of organic carbon presented on the earth is in the form of gas hydrate, found either in marine sediments or in permafrost, both being porous media. Extraction of methane from hydrates could provide a future energy resource.

2 Methane is a greenhouse gases 20 times potent than carbon dioxide. The volume of methane currently bound in hydrate is thought to be

many thousand times that held in the atmosphere. Loss of stability in seafloor hydrate could lead to significant global warming, sea-level rise, and global climate destabilization.

3 There is some evidence to suggest that dissociation of gas hydrate can be a trigger for long run-out submarine landslides. These huge events are known to have led in the past to major tsunamis and widespread flooding and devastation along the continental littoral.

4 Oil and gas exploration and development are now extending far off the continental shelf, into water depths considerably deeper than 1000m. In this depth of water hydrates can occur at relatively shallow depths below the sea bed. There is concern that hydrocarbon exploration and development activities may trigger either dissociation or slope instability.

A common interest concerned with submarine hydrates is the need to identify their global and local occurrence, concentration and form and methods for exploitation. Because hydrates exist only under very restricted conditions, it is difficult to determine their presence and properties by drilling, or to bring undisturbed specimens to the laboratory for testing. A more promising method of locating and characterizing hydrates comes from the development of marine seismic geophysical testing. However, the development, validation, and optimization of seismic surveying techniques require an understanding of the relation between sediment type, hydrate form and content, and the physical and mechanical properties of the sediment.

Exploitation of natural gas hydrate is connected with the percolation and control of multiple media in the stratum. Only there is accurate understand of the permeability, the thermal characteristics and the characteristics of strength and the relationship of stress-strain, the real dissociation course in hydrate deposit may be obtained (Wu et al, 2003; Guerin et al., 1999).

Up to now, the data about the mechanical properties of gas hydrate is very lack. The reason is that the samples obtained from site is few, and the technology of synthesis for hydrate deposit is matured only in recent years (Lee and Collett, 2001; Winters et al, 2004). Some studies