

## Problems of Hydrate Formation in Oil and Gas Pipes Deals

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**Abstract:** Iran among countries which have rich reserves of natural gas is one of the issues related to natural gas; gas hydrate formation that can cause problems in oil and gas industries to make, though the recent formation of hydrate as an advantage special use is named. But the hydrate formation in natural gas pipelines increased flow pressure drop flow path blockage and sometimes explosive pipeline will flow every year and ultimately lead to injury very much for the cost of oil and gas industry in Iran and around the world is. Hence the ability to predict hydrate formation conditions from the standpoint of production process, transfer and utilization is important and can prevent unexpected problems. In terms of structure, the solid hydrate material is a physical mixture of water with some hydrocarbons in the natural gas comes despite apparent or like ice, its properties are different. This article reviews the problems of hydrate formation in oil and gas pipes deals.

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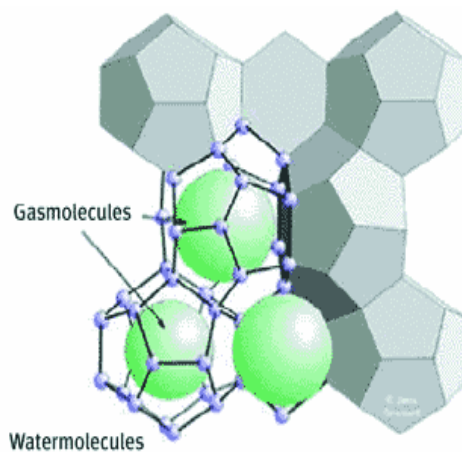
### 1. Introduction

World gas reserves recorded to the beginning of 2008 AD 36 / 177 trillion cubic meters estimated that 8 / 27 trillion cubic meters of reserves located in our country and Iran having 7 / 15 percent of world gas after Kshvrvsyh (7 / 26) is in second place. Natural gas and crude oil in natural underground reservoirs are in contact with water. Because water molecules have strong hydrogen bonds formed with holes create a network-like structure My dhndkhatr having strong hydrogen bonds with the holes creating a network-like structures are composed of gas molecules (guest) with molecular diameters smaller than the diameter of holes inside the cages by water molecules (hosts) and through hydrogen bonds between them created and trapped due to interaction between the guest and host molecules create a stable structure is formed and the crystalline substance like ice known as gas hydrate be.

Gas hydrate crystals or a combination Hydra hay thrush species of water and gas are the first ice may be confused or regular thrush. Kiatrytha some combination of host molecules and one guest are made. Stability of these compounds to the presence of both components and complete dependence on the host molecules by forming holes in their guest molecules are replaced.

Phenomenon of gas hydrate formation in water molecules, which play the role of host molecules by forming hydrogen bonds with the hollow bring into existence a certain temperature and pressure of the guest molecules the holes and empty spaces are inside the holes can be hydrate crystals to fall and create. There are many gases that can play the role of guest molecules such that the gas can be methane,

ethane, propane, carbon dioxide, hydrogen sulfide and more pointed. Figure (1) penetration of gas into the hollow cavities which ultimately can lead to formation of hydrate crystals can be seen.



**Figure 1.** Host molecules (water) and guests (Gas)

Note that is essential in this type of crystals of any type of chemical bond between water molecules into the gas holes are being created and sustained is not dependent on the crystal hydrate hydrogen bonds between water molecules (host molecules) and van deer Waals forces between host molecules - there are guests coming. A result to research conducted in 1950 has identified three conditions necessary for hydrate formation is:

- 1 - Water as ice or liquid phase
- 2 - There are small gas molecules such as methane, ethane, propane, and argon

3 - High pressures and low temperatures when hydrate crystals on an industrial scale for the first time were considered the cause of obstruction Variety natural gas transmission lines were introduced. Figure 2 by blocking the pipeline hydrate crystals is seen.



**Figure 2.** Hydrate formation in natural gas transmission pipeline

At the same time, researchers were looking for ways to prevent formation of hydrate crystals, but with time it became clear the fact that hydrate formation is always a negative phenomenon is not considered. Formation of hydrate crystals can be as a way to soften water, sea, natural gas storage and separation of two or more minor component, supplying oil and even fruit can be used for hydrogen production.

## 2. Discovery History hydrate

History discovered natural gas hydrate is divided into three main periods.

First period of interesting phenomena related to the formation of hydrate science. Because the accumulation of water and gas together as a hydrate phase due to lack of compliance with the terms and scientific information at that time (non-mixing of water and gas) is an interesting phenomenon. The exact course of the year 1810 CE the same time discovering the whereabouts hydrate started continues.

The second term is related to the year 1934. With more extensive research on gas hydrate structure reveals the fact that Crick thought the natural gas transmission pipeline route at low temperatures due to freeze Animate and not because of favorable conditions for gas hydrate is formed in other words this part of History devoted to the discovery of natural gas hydrate problems of hydrate formation is an unwanted cases.

Third term in 1960 simultaneously with the discovery of large amounts of these molecules in the ground layers contain large amounts of natural gas

are much devoted to the fact hydrate History found. So today the confluence of three periods hydrate history is important and that same appeal in certain aspects of the existence of hydrate hydrate this part of history brings.

### 2.1. Hydrate structure

In terms of structure, the solid hydrate material is a physical mixture of water with some hydrocarbons Degas existing natural and comes despite the appearance like it has different properties of ice.

Researchers studying the structure of liquid water, they realized that the rings formed by water molecules due to hydrogen Append very stable open chain of molecules are the same number. According to the network forming ability of water molecules in the empty hydrate is unstable mode for four-hydrate structure is marked:

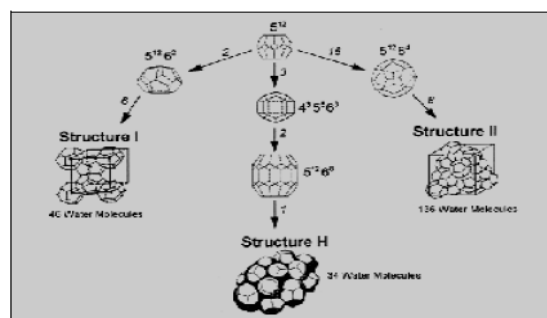
I kind of structure

Type II structure

Structure type H

And a new structure that has no name yet.

Final structure is applied in chemical engineering and the structure is relatively new.



**Figure 3.** Different hydrate structures and holes in their buildings

**Table 1.** Natural gas hydrate-forming gases and how the various water holes occupied by them

Compound	Structure I		Structure II	
	Small cavities	Large Cavities	Small cavities	Large cavities
CH <sub>4</sub>	+	+	+	+
C <sub>2</sub> H <sub>6</sub>		+		+
C <sub>3</sub> H <sub>8</sub>				+
C <sub>4</sub> H <sub>10</sub>				+
<i>I</i> -Butane				+
Co <sub>2</sub>	+	+	+	+
N <sub>2</sub>	+	+	+	+
H <sub>2</sub> S	+	+	+	+

### 3. Application of gas hydrate

Hydrate is the first time as a factor in the obstruction of gas pipes have been understanding, but today many studies done on these compounds and has found many applications.

- 1 - Natural gas storage.
- 2 - Absorb carbon dioxide from the air
- 3 - The process of separating mixed gases
- 4 - Cold reservoir

Hydrate formation problems in pipes In 1934 when oil and gas industry in America was growing rapidly became obvious fact that, despite initial impressions, Eclipse natural gas transmission pipeline route at low temperatures is due to create ice crystals Vet hydrate is formed.

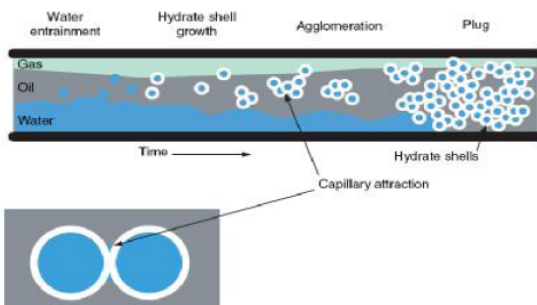


Figure 4. Eclipse pipes in oil pipes

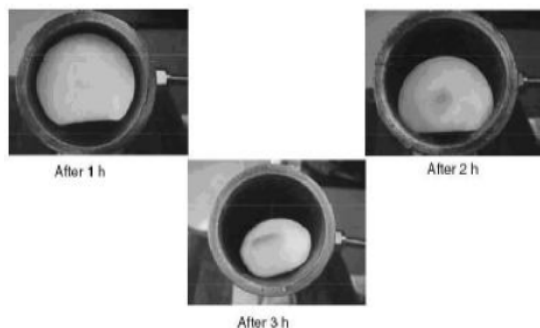


Figure 5. Eliminate clogging pipes with time



Figure 6. Bust pipes on hydrate formation

### 4. Conclusion

Hydrate formation process and its determinants after much research on macroscopic hydrate formation is still a lot Sylvia microscope after its formation remains. Hydranth growth in the saturated solution of water and guest molecules in the interface water - guest molecules (in gas or liquid phase) or in the common ice season - hydrate occurs. Common features of the season thus play an important role in the growth mechanism plays.

Influence or guest water molecules in hydrate growth and decomposition Hydranth is very important. This influence depends on thermodynamic conditions of temperature and pressure and how to interface hydrate - liquid. Why or how making the motion of molecules in hydrate is very important.

Experimental techniques in the vacuum level review is conducted to study the surface Hydranth gas molecules guests are not used. Because water molecules and guest interaction is weak and based on structural similarity is the hydrate and ice, so we can expect that the surface phenomena in both ice and hydrate system is just the same, so the phenomenon of much help on ice to understand the hydrate. For more complex structure of the hydrate due to the joint surface with water or gas, add more size and computing time is required. Due to high water and guest molecules in the unit cell calculations are more difficult and must calculate the total energy potential in experimental use.

Many experiments study hydrate stable, specifications and structural dynamics, the volume occupied cages and vibration spectrum has been hydrated. But still a common phenomenon of the season has not been paid.

#### Memory phenomena

If the hydrate is formed on the water already in the process of hydrate formation and destruction has been used, less time is required for the formation of the hydrate is a phenomenon called memory phenomenon.

#### 4.1. Bridge work

If the water drops already formed crystals and destroyed the company is, I will re-hydrate formation induction time is less; seen that if a drop in the presence of the hydrate memory is added to water droplets, the hydrate formation time for a new water droplets time, the water droplets time memory effect is the phenomenon called Paul.

Methods to prevent formation of gas hydrate Although Hydra hay high pressure gas and low temperature, but this situation occurs for each line pipe for oil and gas used may arise.

To avoid blocking pipes hydrate formation should be prevented. Different methods to prevent

hydrate formation include: maintenance of low pressure gas flow in the hydrate formation pressure, temperature and composition at a specified percentage of vapor phase.

B) Keeping the temperature higher than the flowed gas hydrate form and pressure in a combined percentage steam.

C) To prevent water in liquid phase by reducing the amount of water pipelines in the system. D) Injection inhibitors that are divided into two categories: thermodynamic inhibitors and specific inhibitors.

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