

СЕКЦІЯ «БОРОТЬБА З УСКЛАДНЕННЯМИ ПРИ ЕКСПЛУАТАЦІЇ СВЕРДЛОВИН»

по автотрасі, а також можливість швидко складатися і розкладатися для роботи на свердловині при переїзді з однієї свердловини на іншу.

Створена установка по отриманню в умовах жорсткого режиму навантаження даних довговічності зразків труб, розроблена і реалізована методика тарування установки, проведені випробування на малоциклічну втому зразків із нової гнучкої труби, труби з випрацюваним ресурсом на 50 % і 100 %.

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УДК 553.981

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THE METHODS OF CONTROLLING OF GAS HYDRATES FORMATIONS

Many components of natural gas (methane, ethane, propane, isobutane, carbon dioxide, nitrogen, hydrogen sulfide) in combination with water form gas hydrates - solid crystalline compounds that exist at high pressures at temperatures above 0 °C. During gas production, hydrates can form in field communications and wellbores. Laying off on the pipe walls (especially in the locations of fittings, valves, turns, etc.), hydrates drastically reduce their throughput, up to the complete cessation of gas flow [1, 3 – 5].

Hydrates are non-stoichiometric compounds-inclusions of variable composition, and the equilibrium conditions of their existence (i.e. temperature and pressure) are strongly influenced by the composition of the gas, as well as the presence of salts and other antifreezes in water (received the name of hydrate formation inhibitors in gas practice), reducing both the freezing point of water and the equilibrium temperature of hydrate formation.

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It is necessary to know with sufficient accuracy the temperature of the onset of hydrate formation for gas from each investigated area in the operating pressure range for successful testing, development, and operation of gas wells, and in order to select and calculate the amount of hydrate formation inhibitor.

Gas field systems, in which the formation of technogenic gas hydrates is possible, include: well bottom zone, borehole; loops and collectors; gas treatment facilities; main sections of gas pipelines; gas distribution stations; field and trunk pipelines; gas treatment and processing plants.

A number of methods have been developed in order to prevent hydrates, the ones using chemical reagents are shown in Figure 1. They include hydrate formation inhibitors [2, 3, 5].

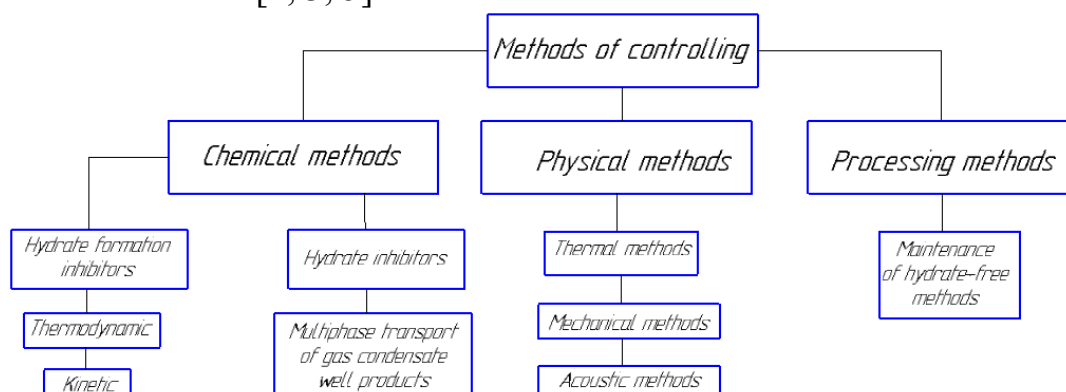


Figure 1 – Methods of dealing with technogenic hydrate formation in the gas field and gas transportation systems

The formation of hydrates in wells and field gas pipelines and the prevention method choice mostly depends on the formation temperature, climatic conditions, and the well operation regime.

A specific application of various methods of preventing hydrate formation is shown below. Among them, there is a prevention and elimination of gas hydrates in various gas field systems.

The formation of hydrates in the wellbore can be prevented by thermal insulation of flowing or casing strings, by raising the temperature of the gas in the barrel by using heaters. The most common way to prevent the formation of hydrates is to feed inhibitors (methanol, glycols) into the gas stream. Sometimes the inhibitor feeds through the annulus. The choice of reagent depends on many factors.

The place of the beginning of hydrate formation in wells is determined by the point of intersection of the equilibrium hydrate formation curve with the gas temperature variation curve along the wellbore (Fig. 2).

In practice, the formation of hydrates in the wellbore can be prevented by reducing the working pressure at the wellhead and reducing the gas flow rate. If the hydrates do not completely cover the well cross-section, it is the easiest to achieve by decomposition utilizing inhibitors. It is much more difficult to deal with

hydrate deposits that completely overlap the cross section of the production string and form a continuous hydrate plug. With a small length of the tube, its elimination is usually carried out by blowing a well. With a considerable length, a plug is ejected into the atmosphere before a certain period during which it partially decomposes as a result of a pressure decrease. The duration of the hydrates decomposition period depends on the length of the plug, the gas temperature and the composition of rocks. Solid particles (sand, sludge, scale, mud particles, etc.) slow down the decomposition of the plug. To accelerate this process, inhibitors are used [2, 6, 7].

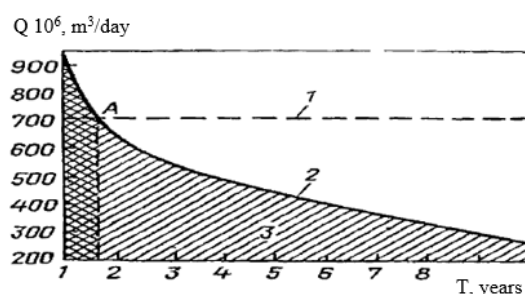


Figure 2 – The change in the allowable flow rate, which prevents the formation of hydrates, in the process of field development: 1 – is the allowable flow rates line; 2 – is the project flow rate; 3 – is the hydrates zone

It should also be taken into account that when a hydrate plug is formed in the zone of negative temperatures, the effect is obtained only with a decrease in pressure. The fact is that the water released during the decomposition of hydrates at a low inhibitor concentration may freeze and an ice plug forms instead of a hydrate one, which is difficult to eliminate.

If a long plug is formed in the wellbore, it can be eliminated by applying the closed circulation of the inhibitor over the plug. As a result, mechanical impurities are washed out, and an inhibitor of high concentration is constantly contained on the surface of the hydrate plug.

To prevent the formation of hydrates in the wellbores, traditional methods are used, they are maintenance of hydrate-free modes, prevention of hydrate deposits and the flow of inhibitor to the bottom of the well.

The place of formation of the hydrate plug is usually determined by the increase in pressure drop in a given section of the pipeline. If the plug is not solid, then an inhibitor is introduced into the pipeline through special connections, fittings for pressure gauges or through a purge plug. If solid hydrate plugs of small length were formed in the pipeline, they can sometimes be eliminated in the same way.

With a cork length of hundreds of meters, several windows are cut out in the pipe above the hydrate plug and methanol is poured through them. Then the pipe is welded again.

A combined method is used for a rapid decomposition of the hydrate plug: the pressure is being reduced simultaneously with the introduction of the inhibitor in the zone of hydrate formation [3, 4].

Maintenance of hydrate-free (idle) modes of wells is achieved by selecting the appropriate working well rates, providing the temperature at the mouth above the equilibrium temperature of hydrate formation. It is possible to increase the temperature of the gas at the wellhead by partially throttling the gas at the bottom of the well, using heat-insulated casing or lift pipes, etc.

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УДК 66.074

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УДОСКОНАЛЕННЯ ІНГІБІТОРУ УТВОРЕННЯ ГАЗОВИХ ГІДРАТІВ ТА ВУГЛЕКИСЛОТНОЇ КОРОЗІЇ

Видобування і підготовку газу до транспортування дуже ускладнює утворення гідратних пробок та корозія [1 – 3].

Одним із найбільш простих, ефективних і в переважній більшості економічно вигідних методів боротьби з процесами гідратоутворення і корозії є використання інгібіторів.