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Chemical Recovery of Gas Hydrates using Fluorine Gas and Microwave Technology

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Abstract

Methane gas hydrates are cages of water molecule that trap small, low molecular weight gas molecules e.g. methane, ethane, hydrogen sulfide etc. the enormous quantity of gas stored in them ($1m^3$ G.H = $180m^3$) makes them an important area of research for the scientist and petroleum engineers.

Over the years the various theoretical techniques for recovery of the gas hydrates are 1.thermal injection 2.inhibitors 3.depressurization. However due to inefficient and economic unfeasibility it is difficult to recover the methane from gas hydrates.

Low injectivity reservoir, small thickness of G.H bearing zone, heat loss especially in permafrost region, also the cost of the inhibitors (which change the thermodynamic condition) is litre of methanol makes it uneconomical, finally depressurization of an adjacent free gas zone can effectively dissociate hydrate but the endothermic nature of the hydrate decomposition will decrease the reservoir temperature and which may temporarily decrease the flow rate.

The technical problems with estimating the gas hydrate are

1. Technology to safely and economically produce methane from G.H deposits.
2. Safety and drill floor stability related issues related to drilling through G.H bearing accumulations.

This paper deals with a new technique of a In this technique, the pressure of the fluids in contact with hydrate is lowered, pushing the hydrate out of its stability region and leading to its decomposition. Because no extra heat is introduced into the reservoir, the heat of decomposition must be supplied from the surrounding formation.

recovery of methane from G.H.This technique involves use of a micro strip antenna which has huge power gain and is relatively inexpensive, with wire line the tool is placed in well bore and frequency of 2450 MHz is released which melt the G.H into water and methyl radical (as they are almost similar to ice) such that they disturb the thermodynamic condition, then the fluorine is injected, this results in reaction between methyl radical and injected fluorine (halogenation), which is strongly exothermic (-431KJ/mole), this reaction propagates the reaction and simultaneously we have solubility of methyl fluoride with water which is 166cc/ 100 ml of water. This pressurized gas solution is then recovered via tubing from production well. Later by applying wurtz reaction, electrolysis and cracking methane can be recovered.

The main advantage of using this technique is micro waves interact strongly with some materials and weakly with others, energy absorption depends on microwave frequency, sample composition, temperature. The chemical compound fluorine is abundant in nature (540000ppb) and methyl fluoride is environmental friendly.

Production Methods of Gas Hydrates

Historically, the petroleum industry's interests in methane hydrates have primarily been related to safety issues such as wellbore stability while drilling, seafloor and formation stability, platform subsidence and pipeline plugging. Gas hydrates as an energy commodity is commonly grouped with other unconventional hydrocarbon resources that are