

Effect of Magnetic Field on Gas Hydrate Formation

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Abstract

One of the foremost vital problems associated with fossil fuel hydrate that mentioned in each terms of issues and opportunities is considering the amount of fossil fuel as hydrate or blockage the pipelines. This study examined the fossil fuel of associate Iranian field with hydrate formation within the presence and absence of the various magnetic fields. For this purpose, associate equilibrium diagram of hydrate formation was drawn and also the effects of 1000G (Gaussian), 2000G, 3000G, and 4000G on hydrate formation were investigated. The results indicated associate inhibition impact for the presence of flux. The results show the subsequent changes: at temperatures prodigious fifteen °C, decreasing the flux multiplied the hydrate formation inhibition, and at temperatures below 15°C, increasing the flux slashed the hydrate formation inhibition. Indeed, the foremost appropriate worth of flux within the tested flux is 2000 Gauss.

Keywords: Gas hydrate; Magnetic field; Hydrogen bond; Phase equilibria curve; Hydrate substance

Introduction

Hydrates area unit a sort of clathrate that could be a cluster of compounds. Once several compounds found in fossil fuel mix with water, they type hydrates. Water's ability to create hydrates is attributed to gas bonds of water molecules. The hosts molecules area unit water molecules, and also the guest molecules area unit the molecules of different compounds that facilitate stabilize the crystal. The steadiness provided by guest molecules is principally attributed to van der Waals forces. These forces represent the attraction between molecules (not because of electricity attraction). There's no bond between the host and guest molecules in hydrates. Within the cages fabricated from host molecules, the guest molecules area unit liberated to rotate and move. Reckoning on the formation of the hydrate and that molecule is that the guest, four hydrate structures might type like the S-I boxlike structure, S-II boxlike structure, easy hexangular (SH) structure, and a replacement anonymous structure [1]. The S-I structure contains molecules smaller than half-dozen Å, like gas, ethane, carbonic acid gas, and sulphide. Larger molecules ($6 \text{ \AA} < d < 7 \text{ \AA}$) like gas and isobutene type the S-II structure. Molecules in size go ($7 \text{ \AA} < d < 9 \text{ \AA}$), like isopentane and neohexane, will type S-H only if there are a unit smaller helper molecules like gas [2-3]. Hydrate formation needs the subsequent 3 conditions: correct combination of temperature and pressure (low-temperature and hard-hitting conditions), existence of a hydrate maker likes gas moreover as C₂H₆, and adequate quantity of water. The factors that irritate this development embody high speed, turbulence, and locations like valves and boiling points. Though gas hydrates type at air mass and temperature, they will occur in any oil and gas pipeline. Hence, hydrate formation should be avoided to stop the transfer pipes from changing into clogged [4]. When fossil fuel 1st causes corrosion within the transmission pipeline, there's a balance between water and fossil fuel in gas reservoirs, among additional distributing modification within the fossil fuel. Second, corrosion within the transmission pipeline reduces natural gas's heat worth. Throughout fossil fuel transmission, increasing the pressure or decreasing the temperature leads to the condensation of water and water drastically reduces the potency of gas transmission lines. Finally, associate excessive temperature visit winters or once a decrease in adiabatic pressure, that causes a fast visit temperature, leads to the formation of hydration; thus, the first inhibition methodology is to dehydrate the gas before causation it to the pipeline. Still, complete dehydration is much

not possible [5]. To avoid the formation of hydrates, the system pressure should be reduced. Further, it should not be at intervals the hydrate formation direct wellhead and downstream conditions. Still, system temperature and pressure might enter the hydrate formation direct the transmission path and might be aloof from this space by lowering the system pressure. However, despite its simplicity, this methodology isn't possible for economic reasons. One different methodology is to insulate the transfer tubes to stop the temperature of the fluid from dropping below the physics equilibrium temperature of hydrate formation though this methodology is pricey it's one amongst the effective strategies [6]. Nowadays, chemical inhibitors area unit won't to forestall the formation of hydrates. Chemical strategies, as well as the addition of inhibitors, area unit the foremost economical however expensive strategies of preventing hydrate formation. Chemical inhibitors area unit divided into physics and kinetic inhibitors classification [7-9]. The kinetic substance, in contrast to the antiagglomeration substance, doesn't need the presence of a liquid organic compound section. Hydrate nucleation is delayed during this methodology, and hydrate crystal growth to larger sizes is prevented. These inhibitors were 1st studied in 1988 at the University of Mainz. In 1994, Long et al. planned a technique for work varied materials as kinetic inhibitors [10]. Considering the properties mentioned for every of the physics, kinetic, and antiagglomerant inhibitors, it may be terminated that in some cases, they will be used at the same time [11]. The results of the analysis show a discount within the transportation prices by ship, maintenance price of gas pumps for injection of physics inhibitors, production of aspect effects of physics inhibitors, price of lifting on the platform, and govt price for the coinciding use of those inhibitors moreover as reduction in corrosion and pressure distinction within the pipeline. Cold flow could be a new methodology of preventing hydrate formation, and none of the

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Received: 02-Dec-22, Manuscript No. ogr-22-83989; **Editor assigned:** 05-Dec-22, PreQC No. ogr-22-83989(PQ); **Reviewed:** 20-Dec-22, QC No. ogr-22-83989; **Revised:** 26-Dec-22, Manuscript No ogr-22-83989 (R); **Published:** 30-Dec-22, DOI: 10.4172/2472-0518.1000279

Citation: Zhou H (2022) Effect of Magnetic Field on Gas Hydrate Formation. Oil Gas Res 8: 279.

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abovementioned strategies area unit used this methodology, in contrast to different strategies, doesn't attempt to forestall hydrate formation. Conversely, this methodology forms hydrates 1st so injects the fashioned hydrates into the pipeline. Hydrates area unit 1st fashioned within the cold flow methodology so flow as a hydrate suspension within the pipeline. The cold flow technology is predicated on the principle that once there's a break of sediment formation or association within the liquid being transferred within the pipeline, by cooling it, the thrust is totally eliminated or decreased. This can permit simple transfer while not blockage over long distances [12].

Discussion

These results counsel that many mechanisms have an effect on hydrate formation. Still, within the early stages of hydrate formation, the reduction in temperature is that the main impact due to supplying the thrust for hydrate formation (for gas we have a tendency to obtained the curve to 15°C). Once this time (15 °C), the flux is dominant due to destroying the gas bonds of water and disrupting the cage arrangements. Increasing the impact of temperature on the flux may be because of the saturation of flux by temperature. Saturation of the flux is that the most probable reason for decreasing the inhibition impact of the magnetic field; this impact has been evaluated by many researchers [13].

The flux decreases the facial tension of water, thus increasing the solubility of water additionally weakens the gas bonds, so changing water-free molecules. Due to the gas bond's major operate on gas hydrate formation, it's necessary to check the flux impact on gas hydrate formation. The results show that the flux inhibits hydrate formation as all curves area unit shifted to the left which totally different magnetic fields influence hydrate formation otherwise. The obtained curves show that the impact of flux magnitude is bigger at low temperatures. Another purpose price noting is that at temperatures prodigious 15°C, a decrease within the flux caused a rise in hydrate formation inhibition and at temperatures below 15°C, a rise within the flux caused a decrease in hydrate formation inhibition. Moreover, within the general comparison, it's clear that the flux impact has associate optimum quantity. Because the flux impact will increase by decreasing the sphere magnitude from 2000 G however the impact at a 1000G is a smaller amount than that at 2000 G, therefore the flux with 2000 G magnitude is that the optimum field magnitude to inhibit the hydrate formation. Another new analysis was regarding the impact of electrical field on gas hydrates; therefore, we have a tendency to set to analyze the impact of the presence of a flux and its magnitude on hydrate formation. Flux decreases the facial tension of water, increasing the solubility of water and weakening the gas bonds, so changing water-free molecules (Magnetic fields weaken the gas bonds, implying that there's enough strength within the bond to stay as water). Due to the gas bond's major operate on gas hydrate formation; it's helpful to check the flux impact on gas hydrate formation. This analysis aims to get the fossil fuel equilibrium points with and while not the flux. To look at the impact of flux and its magnitude on gas hydrate formation, the flux impact on the hydrate formation of input gas was investigated with a magnitude of a thousand G, 2000 G, 3000 G, and 4000 G. The results were analyzed and investigated [14].

Conclusion

In this study, we have a tendency to investigate the impact of the presence and absence of a flux on fossil fuel hydrate formation. The results show associate inhibition impact for the presence of a flux. Also, we have a tendency to examine the impact of the magnitude of the flux. From the obtained results, we have a tendency to conclude that the magnitude of the flux changes by activity. During this case study (natural gas with dominant gas composition), 15°C was the vital temperature purpose. Moreover, it may be aforementioned that for inhibition hydrate (especially gas hydrate), the flux incorporates a positive impact and a 2000 G flux while not considering the temperature will forestall association. As mentioned within the literature, chemical inhibitors and different ways that to stop hydrate area unit expensive; but, mistreatment the static flux will cause cheap inhibition [15].

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