Methane Production through Combined Depressurization + Hydrate Swapping method in the Sandy Porous Medium under Permafrost Temperature Conditions

Pandey, Jyoti Shanker; von Solms, Nicolas

Publication date: 2019

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Methane Production through Combined Depressurization + Hydrate Swapping method in the Sandy Porous Medium under Permafrost Temperature Conditions

Jyoti Shanker Pandey*, Nicolas von Solms**
*PhD Student-CERE, **Associate Professor-CERE

1- Introduction

Methane gas production recovery from gas hydrates
- Depends on the characteristic of porous media
- Production techniques.
In this work,
- Combined pressure reduction and Flue gas injection
- Permafrost temperature conditions (1°C to -5°C)
- Different porous medium

Objective
- To analysis effect of temperature on methane recovery
- To analysis effect of methane self preservation on CH₄-CO₂ swapping
- To analysis the effect of sediments on CH₄ recovery in permafrost conditions.

2- Background Information

- Permafrost gas hydrate deposits are metastable state., represent mainly gas-ice hydrate system and hard to distinct from ice.
- Gas hydrate particle covered with thin ice films which prevent further hydrate dissociation.
- Presence of clay particle inhibits hydrate crystal growths. Methane hydrate formation, stabilization and preservation in frozen clay is unclear.
- Conversion of ice to hydrate is quite rapid below 273K.

3-Experimental Setup

Figure 1: Systematic diagram of Core flooding setup used during the experiment.

4-Experimental Data Processing

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Methane injection pressure (bar)</th>
<th>Hydrate formation temperature (°C)</th>
<th>Type of gas injection</th>
<th>Flue Gas injection pressure (bar)</th>
<th>permanfrost temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp-1</td>
<td>3.5</td>
<td>-6</td>
<td>CH₄</td>
<td>101</td>
<td>-2.36</td>
</tr>
<tr>
<td>Exp-2</td>
<td>94</td>
<td>1.8</td>
<td>CH₄</td>
<td>98</td>
<td>-10.26</td>
</tr>
<tr>
<td>Exp-3</td>
<td>82</td>
<td>0.872</td>
<td>CH₄-CO₂</td>
<td>94</td>
<td>0.872</td>
</tr>
<tr>
<td>Exp-4</td>
<td>95</td>
<td>0.315</td>
<td>CH₄-CO₂</td>
<td>102</td>
<td>-4.63</td>
</tr>
<tr>
<td>Exp-5</td>
<td>95</td>
<td>3.83</td>
<td>CH₄-CO₂</td>
<td>102</td>
<td>-5.31</td>
</tr>
<tr>
<td>Exp-6</td>
<td>104</td>
<td>1.09</td>
<td>CH₄-CO₂</td>
<td>100</td>
<td>-4.35</td>
</tr>
</tbody>
</table>

5- Conclusions

Figure 2: Typical P-T variation in core based gas hydrate swapping experiment in lab in permafrost condition.

Figure 3: Typical P-T variation in core based mixed gas hydrate self preservation analysis at the end of the experiment while in permafrost condition.

Figure 4: Typical P-T variation in core based methane hydrate self preservation analysis at the end of the experiment while in permafrost condition.

6-References