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

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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-glace 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 pore 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>Exp-1</th>
<th>Exp-2</th>
<th>Exp-3</th>
<th>Exp-4</th>
<th>Exp-5</th>
<th>Exp-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane injection pressure (in bars)</td>
<td>2.1</td>
<td>2.4</td>
<td>2.1</td>
<td>2.1</td>
<td>2.0</td>
</tr>
<tr>
<td>Hydrate formation temperature (℃)</td>
<td>10% CO₂</td>
<td>10% CO₂</td>
<td>10% CO₂</td>
<td>10% CO₂</td>
<td>10% CO₂</td>
</tr>
<tr>
<td>Type of gas injection</td>
<td>Core 1 Inlet</td>
<td>Core 2 Inlet</td>
<td>Core 3 Inlet</td>
<td>Core 1 Inlet</td>
<td>Core 2 Inlet</td>
</tr>
<tr>
<td>Flue Gas injection pressure (in bars)</td>
<td>0.26</td>
<td>0.28</td>
<td>0.26</td>
<td>0.28</td>
<td>0.28</td>
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<tr>
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<td>10</td>
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6- References