Thermodynamics and Transport of Gases in Polymer Liners for Subsea Applications

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Introduction

• Flexible Pipelines:
  – better alternative to the rigid pipes – more economical solution;
  – concentric layers of polymeric and steel materials.

• Transport of CO₂ to [1]:
  – Injection into oil reservoirs for EOR;
  – Injection into coal reserves to extract CH₄;
  – As CCS method.

Experimental

• Solubility Set-up

• Permeability Set-up

Results

• Solubility

• Permeability

Conclusions

Solubility
• Temperature influence: Arrhenius temperature dependency;
• Pressure influence: increases with increasing pressure;

Permeability
• Temperature influence: Arrhenius temperature dependency;
• Pressure influence: PVDF and PA11: increases with increasing pressure
  - XLPE: decreases with increasing pressure
• CH₄ influence: decreases with CH₄ presence

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Figure 1 – Experimental results for solubility of CO₂ in (a) PVDF and (b) XLPE at 45 °C and 90 °C. The dots represent the experimental data and the lines represent the model prediction using sPC-SAFT equation of state.

Figure 2 – Experimental results for permeability of 100 % CO₂ in (a) PVDF, (b) XLPE and (c) PA11 at 45, 60, 75 and 90 °C.

Figure 3 – Experimental results for permeability of 90% CO₂ + 10% CH₄ in (a) PVDF and (b) XLPE at 45, 60, 75, 90, 110 and 130 °C.