

Water content of carbon dioxide at hydrate forming conditions

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ABSTRACT

There is an interest to ensure sub-saturated water content in lines containing carbon dioxide in applications such as enhanced oil recovery and carbon sequestration, to reduce risks of hydrate blockage and corrosion. The water content of carbon dioxide at various temperatures and pressures has been measured in the past, but there is no consistent set of measurements that could be used for carbon dioxide storage and transportation design work. The solubility of water in a carbon dioxide rich gas phase at hydrate forming conditions was measured in this work. Pressures ranged from 12.06 to 29.30 bar along two isotherms, 1 °C and -7 °C, all within the gaseous carbon dioxide and hydrate stability zone. For the first time in these types of measurements, the solid phase was also characterized and confirmed to be carbon dioxide hydrate via X-ray computed tomography, simultaneous with water content measurements of the gas phase. Once carbon dioxide hydrate conversion had reached a maximum value (65% estimated by X-ray computed tomography), the equilibrium water content was measured. Prior to reaching this maximum carbon dioxide hydrate conversion, the water content in carbon dioxide was observed to decrease as liquid water converted to carbon dioxide hydrate. This slow conversion to hydrate, metastability of the hydrate phase, or unexpected phases may be responsible for the large discrepancy between prior data sets for similar carbon dioxide water content measurements.

KEYWORDS

Carbon dioxide; Clathrate hydrate; Water content; Metastability; X-ray Computed; Tomography

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