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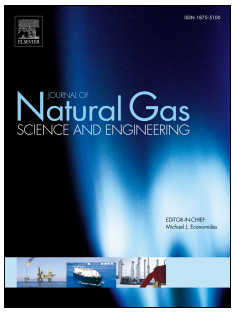

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In Situ Measurement of Physical Solubility of Carbon Dioxide in Loaded Aqueous Monoethanolamine by Raman Spectroscopy

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Abstract—Physical solubility is a physicochemical parameter necessary for reaction kinetic study and modeling CO_2 separation process. When CO_2 absorb into liquid phase and react with solvent, shift in chemical composition and equilibrium results in change in properties of solvent. As CO_2 absorption is a continuous process with CO_2 dissolving into partially loaded solution most of the time, availability of a robust technique to access unreacted CO_2dissolved in aqueous phase is crucial to study effect of CO_2 loading on physical solubility. Current work investigates physical solubility of CO_2 in loaded monoethanolamine (MEA) solution at elevated pressure conditions by direct measurement of unreacted CO_2 dissolved in the solution using Raman spectroscopy. This spectroscopic method does not require N_2O as surrogate gas, hence eliminates the need of N_2O analogy to estimate solubility of CO_2. Impact of varying CO_2 loadings on Henry's constant is examined.

Keywords—CO_2 absorption; CO_2 loading; equilibrium; Henry's constant; MEA;

1. Introduction

CO_2 capture from gas stream is one of the most crucial strategies to reduce greenhouse gas emission from various industries and combat global climate change due to increasing atmospheric CO_2 concentration. Besides, CO_2 separation, also known as gas sweetening, is necessary in natural gas industry to comply with consumers' requirement. In addition, acid gas purification increases calorific value of natural gas, improves pipeline capacity as well as reduces risk of corrosion in pipeline and process equipment. Technologies for CO_2 removal include absorption, adsorption, membrane separation and cryogenic process. Separation by aqueous alkanolamine is broadly applied in large scale acid gas treatment. Monoethanolamine (MEA) is the