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# Equilibrium and compositional properties of CO2 – N2 gas hydrates investigated by Raman spectroscopy

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The global greenhouse effect of CO2 has attracted increased attention as a worldwide problem. CO2 capture and sequestration (CCS) for industry is a great challenge that is susceptible to reduce carbon emission. Exhausting gases from industry contains CO2, N2, CH4, O2 and are generally localized: steelmaking plants, gas or coal power plants, chemical plants... The quantities to be treated are very important, in the range of several cubic meters per second. In post combustion capture, CO2 concentration is generally low, typically 5-10% for power plants, but it can be higher: up to 40% in steelmaking plants, or also in some cases of natural gas production. Different strategies and technologies of capture need to be developed to decrease the cost of the process, in respect to the specific compositions and operative conditions, especially pressure. Hydrate technology could be an alternative that needs further development.

The work that is presented here is a preliminary research to evaluate the equilibrium and compositional properties of gas mixtures of CO2-N2 for potential of CO2 capture using a hydrate technology. A knew experimental set-up has been developed to produce and analyze gas hydrates in-situ by Raman spectroscopy. A high pressure and low temperature optical reactor has been built to investigate thermodynamic equilibrium properties of gas hydrates. The hydrates are crystallized from a mixture of water and gases (CO2 and N2). The characteristic spectral signature of CO2 and N2 trapped in the hydrate structure can be easily distinguished from that in the gaseous phase above the so-formed hydrates. The hydrate phase composition is evaluated by Raman and compared with that obtained from thermodynamic models of hydrate phase equilibrium prediction.