Katlyn LaFranca, Lars Ehm
Abstract for COMPRES

Developing a High Pressure Flow Cell for *in situ* Investigations of the Formation of Gas Hydrates

The rise in global temperatures through increasing concentration of greenhouse gases (such as CO_2) in our atmosphere is a growing problem for Earth's population [1]. Besides reducing the emissions of greenhouse gases, carbon capture at energy generating sources is an increasingly important strategy for a reduction of the global atmospheric CO_2. The technology for carbon capture is rapidly developing, however, the storage of the captured CO_2 remains problematic [2]. A recently proposed strategy is to use the vast deposits of methane-clathrates on the ocean floor in coastal areas, (i) to harvest methane as an energy source and (ii) in return sequester CO_2 in the form of CO_2-clathrates [3]. CO_2 clathrates are more thermodynamically stable than the methane hydrates and are, therefore, less susceptible to decomposition as our oceans warm [4]. However, the formation and decomposition processes of methane- and CO_2 clathrates are not currently well understood. Therefore, detailed investigations of these processes at ocean floor pressure and temperature conditions are needed.

We are developing a high-pressure gas delivery system and flow cell to investigate the formation processes of CO_2 clathrates using high-energy x-ray diffraction techniques. The design of this instrument is based on an existing prototype developed in the Material Science Department at Stony Brook University. A number of adjustments and improvements were made from the originally designed manifold and high-pressure cell. The cell will allow *in situ* diffraction experiments over a wide pressure (1-150 bar) and temperature (90-1200K) range, but will initially be optimized for the formation conditions CO_2 clathrates of pressures of 15-75 bars and temperatures around 273-280 K.

References

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