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The stability of methane hydrates in highly concentrated electrolyte solutions by differential scanning calorimetry and theoretical computation

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ABSTRACT

The stability limits of methane hydrates have been investigated at pressures from 5 to 12 MPa by high-pressure differential scanning calorimetry, in sodium chloride and calcium chloride solutions, at concentrations ranging from pure water to saturated salt, in continuous solutions, in water-in-oil emulsions, as well as in complex dispersed media used as drilling fluids. Experimental results are in good agreement with available data, and concord well with predictions computed using the model of Van der Waals and Platteeuw (1959). DSC experiments revealed eutectic melting of solid mixtures of gas hydrate and crystallized salt. Corresponding invariant temperatures of melting and phase compositions were computed for various gas pressures. Complete phase diagrams are proposed for the systems (methane + water + sodium chloride) and (methane + water + calcium chloride) at 2 MPa and 10 MPa methane pressure.