

P-T Diagram of Elastic Moduli of CO₂ and CH₄ Hydrate

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Abstract The replacement of CH₄ by CO₂ in gas hydrate-bearing sediments has received great attention since it may enable long-term storage of CO₂, which could mitigate the influence of global warming and ocean acidification, and facilitate CH₄ recovery as a potential future energy resource. Elastic moduli of pure hydrate are crucial for evaluating elastic wave velocity of hydrate-bearing sediment in order to monitor the distribution of hydrates occurred in the formation, however, those of CO₂ hydrate have rarely been reported and limited information exists on the differences in mechanical properties between CO₂ and CH₄ hydrates. This presentation shows that CO₂ hydrate anomalously become more rigid and stable with increasing temperature, whereas those of CH₄ hydrate decrease regularly with increase in temperature. The anomaly is attributed to the kinetic behavior of linear CO₂ molecules, especially those in the small cage of gas hydrate. The work provides a key database for elastic properties of gas hydrate. Meanwhile, these findings facilitate predicting formation stability and monitoring distribution of CO₂ and CH₄ hydrate during the replacement process.