

Thermal constants of methane hydrate-bearing sediment and surrounding mud core samples recovered from Nankai Trough well

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This study presents measurements of the thermal constants of natural methane-hydrate-bearing sediments samples recovered from the Tokai-oki test wells (Nankai-Trough, Japan) in 2004. To investigate the influence of sediment composition on the thermal properties, the thermal constants of natural hydrate-bearing sediments were measured at 5 °C and 10MPa over a porosity range of $0.41 \leq \psi \leq 0.47$. In this porosity range, the thermal conductivity of natural hydrate-bearing sediments decreased slightly with increasing porosity. The specific heat of the hydrate-bearing sediments was almost constant and independent of porosity. The thermal diffusivity of hydrate-bearing sediment decreased with increasing porosity.

We also used simple models to calculate the thermal conductivity and thermal diffusivity. The results of the distribution model are relatively consistent with the measurement results. In addition, the measurement results are consistent with the thermal diffusivity, which is estimated by dividing the thermal conductivity obtained from the distribution model by the specific heat obtained from the arithmetic mean.

The thermal conductivity of silt soil in the mud layer sample was estimated by the distribution model, the result of which was much lower than that of the sand soil in hydrate-bearing sediment. This suggests that small grains influence the thermal conductivities.

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Keywords: methane hydrate, thermal conductivity, thermal diffusivity, specific heat, gas hydrate-bearing sediment, hot-disk transient method