Laboratory Thermal Conductivity Measurements in Pure Methane Hydrate Between –5 and –30 °C

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The extensive methane (CH4) hydrate deposits found in shallow permafrost and continental margin sediment has generated interest as a potential natural resource, a submarine geohazard, and a contributor to global climate change. The significance of gas hydrate in these roles depends in part on the effects of temperature on their stability, and hence can be sensitive to exchanges of heat with their environment. Thermal properties such as conductivity and diffusivity are therefore important properties governing the response of hydrate-bearing sediment to natural or man-made thermal perturbations. We seek to improve characterizations of hydrate's *in situ* thermal behavior by making laboratory measurements of thermal conductivity in pure sI CH4 hydrate at near *in situ* pressures and temperatures.

Thermal conductivity measurements are made using the transient hot-wire technique of von Herzen and Maxwell. The needle probe is positioned along the axis of the cylindrical hydrate sample that is synthesized around the probe by heating H20 "seed ice" grains in a pressurized methane atmosphere. To insure thermal contact between probe and sample, and to eliminate the porosity required by our synthesis method, samples are radially compacted after synthesis.

We tested our methodology on granular ice Ih, compacted under vacuum, and its thermal conductivity is 2.16±0.03 W/m·K at –10°C, in agreement with published values. Our preliminary value for conductivity of pure CH4 hydrate, when compacted to less than 5% porosity, is 0.475 ± 0.007 W/m·K at –5°C. Conductivity decreased slightly (0.015 W/m·K) with temperature over the range –30 to –5 °C. At –30°C, thermal conductivity increases with confining pressure by 0.0125 W/m·K as confining pressure increases from 34.5 to 70.1 MPa. Thermal conductivity measurements above 0°C in pure CH4 hydrate are ongoing.