Dissociation characteristics of mixed-gas hydrate composed of methane and ethane

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Natural gas hydrates have been found in the lake-bottom sediments at Lake Baikal, Russia. Kida *et al.* (2006) reported that different crystal structures (st.I and st.II) existed in the same cores of Kukuy K-2 mud volcano. These gas hydrates showed high ethane concentration. Enormous amount of latent heat generates at the formation process of gas hydrates and controlled their thermal condition themselves. Although dissociation heat of pure methane and ethane hydrates was obtained by Handa (1986), little is known about that of mixed-gas hydrates. In this study we investigated the effect of ethane concentration on dissociation heat of mixed-gas (methane and ethane) hydrate.

Samples of mixed-gas hydrate were formed from methane, ethane and distilled water at 274K. About 1g of gas hydrate sample was ground up well in liquid nitrogen and put into a small pressure cell for the calorimeter (Setaram BT2.15). The cell was set into the calorimeter at 93K and then heated from 93K to 298K at a rate of 0.15 (K min^{-1}). Dissociation heat of gas hydrate was obtained by integration of the peak of heat flow and the amount of dissociated gas.

Subramanian *et al.* (2000) reported that st.II gas hydrate appears in appropriate gas composition of methane and ethane. We confirmed by using Raman spectroscopy that our samples had the following three patterns: st.I only, st.II only and mixture of st.I and st.II. Dissociation heat of the mixed-gas hydrates were within the range between those of pure methane and ethane hydrates and increased with ethane concentration, according with the increase in hydration number. In most cases two peaks of heat flow appeared and the dissociation process was divided into two parts. This can be understood in the following that the sample contained both crystal structures, and/or ethane-rich gas hydrate formed simultaneously from dissociated gas and showed the second peak of heat flow.