

### Thermal expansivity of ionic clathrate hydrates

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Even though thermal expansivity is one of the key information to understand thermal nature and host-guest interaction of clathrate hydrates, there have been little trials for the study of thermal behavior of the ionic clathrate hydrates. Novel host-guest interaction is expected by existence of ionic species in the clathrate structure, which seems to create unique thermal behavior compared with that of non-ionic clathrate hydrate. It was proved that X-ray split tetraalkylammonium cations, inducing abnormal lattice expansion of the crystal structure. Accordingly, in this study, neutron powder diffraction (NPD) technique, instead of XRD, was used to measure the thermal expansivities of binary sII  $\text{Me}_4\text{NOD}\cdot 16\text{D}_2\text{O}$  and sI  $\text{DClO}_4\cdot 5.5\text{D}_2\text{O}$ . The ionic clathrate hydrates obeyed general and structure-dependent correlations but the lattice expansion trend was totally different from that of non-ionic clathrate hydrate. Additionally, peculiar thermal expansivity coefficients of binary sI  $\text{DClO}_4\cdot 5.5\text{D}_2\text{O}$  might arise from the unique host-guest configuration of the clathrate structure.