

Nuclear Resonant Inelastic X-ray Scattering Studies of Kr Clathrate Hydrates

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The understanding of the glass-like thermal conductivity of clathrate hydrates has been a subject of numerous practical and fundamental research studies. The role of the guest atoms or molecules in the clathrate hydrate in the thermal conductivity has been intensively studied by both theoretical and experimental methods. Recently it has been shown to be possible to study the dynamics both the clathrate structures stable at low pressures and also the phases that occur at high pressures. The nuclear resonant inelastic x-ray scattering method is ideal for characterization of the dynamics of the guest atom such as Kr since the method can yield the phonon densities of states for the Kr atoms. We present here our experimental and theoretical results on structures and dynamics of both the low-pressure and high pressure clathrate structures including recent variable temperature studies on the high pressure structure H clathrate as obtained at the Advanced Photon Source.