

## Spectroscopic Evidences for the Mixed Hydrogen Hydrate with the Various Guests in the Structure I and II

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It was ascertained that hydrogen molecules were able to occupy the small cavities of structure I and II hydrate by using  $^1\text{H}$  solid-state NMR, Raman Spectroscopic and Gas Chromatographic methods. We confirmed that sI and sII hydrate contained 0.127 and 0.37 mol fraction of  $\text{H}_2$  when the pure ethane (sI) and propane (sII) hydrate was pressurized up to 120 bar with  $\text{H}_2$  at 270K. Occupancy ratios of each cage could be determined from NMR and Raman spectroscopy. They suggest that hydrogen molecules of 0.173 and 0.334 wt% could be contained in mixed hydrate lattice of sI and sII. These results show sII hydrate is more favorable than sI for applying to hydrogen storage.