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Hydrogen Storage in Clathrate Hydrates JOANNA HAAG, TAKESHI SUGAHARA, PINNELLI S.R. PRASAD, ASHLEIGH WARNTJES, E. DENDY SLOAN, AMADEU SUM, CAROLYN KOH — Clathrate hydrates have been investigated as a possible storage medium. There are several advantages of using clathrate hydrates as a hydrogen storage material. Firstly, an advantage is that the system is composed of water. There are no harmful byproducts when the hydrogen is released. In addition, the hydrogen can be released by simply de-pressurizing the system (by turning a valve). Therefore, no chemical reaction is required. However, the disadvantage is that the stability condition for pure hydrogen hydrates is at severe conditions, such as high pressures. In order to alleviate the severe conditions, promoter molecules, for example, tetrahydrofuran are used to shift the phase equilibrium boundary to lower pressures and higher temperature conditions. Other molecules can be used as well. However, the addition of a promoter molecule reduces the possible storage capacity for hydrogen. In this work, new synthesis methods have been studied to increase the hydrogen storage capacity of a hydrogen hydrate system, while stabilizing the system at pressure conditions. The results indicate that using these new methods, the hydrogen and promoter molecules can both occupy the large cage within a certain composition range, which results in a storage amount of 3.4 wt.%.

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