

### Study on the ionic conductivity of tetraalkylammonium cation clathrate hydrates

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Ionic clathrate hydrates are known to create numerous clathrate structures by ionic interaction between guest ions and charged host framework, which are quite different from non-ionic clathrate hydrates stabilized by van der Waals interaction. For this reason, ionic clathrate hydrates exhibit peculiar features such as high proton conductivity and thermal stability compared to ice or non-ionic clathrate hydrates. Tetraalkylammonium cation hydrates are considered as novel proton conductors because of their superionic conduction behavior. The proton conductivities of these materials are quite dependent on the crystal structure, hydration number and guest type. In this study, we presented the ionic conductivities of various tetraalkylammonium cation hydrates and investigated the effect of crystalline structure and the type of anion species.