Effects of large molecular alcohols on phase behavior and structural characteristics of CO_2 and N_2 hydrates

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In this study, the influences of large molecular alcohols on phase equilibria and structures of both CO_2 and N_2 hydrates were investigated. Pinacolyl alcohol (PCA), tert-amyl alcohol (tAA), and tert-butyl alcohol (tBA) were focused as three typical large molecular alcohols, and they were introduced in CO_2 and N_2 hydrates, respectively. For CO_2 hydrates, PCA showed a slight thermodynamic inhibition, whereas tAA and tBA showed significant thermodynamic inhibitions. On the other hand, for N_2 hydrates, all of PCA, tAA, and tBA showed noticeable thermodynamic promotions. Through Raman spectroscopy and powder X-ray diffraction, the structures of both CO_2 + PCA and CO_2 + tAA hydrates were found to be sl, whereas the structure of CO_2 + tBA hydrate was confirmed to be sll. On the other hand, the structures of all three N_2 hydrates with each large molecular alcohol were found to be sH. Here, it was revealed that even though large molecular alcohols inhibit the formation of CO_2 hydrate, they show large promotion with N_2 hydrate and change the structure to sH. Therefore, they are expected to favorably affect the flue gas capture process, and further research should be proceeded with gas mixtures of CO_2 and N_2 .