Thermodynamic inhibition mechanism of CO_2 hydrate formation

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In this work, we investiagted the thermodynamic inhibition mechanism of CO_2 hydrate formation using glycine, L-alanine, and L-valine as a model system. To confirm their capabilities in inhibiting the formation of CO_2 hydrates, three-phase (liquid-hydrate-vapor) equilibrium conditions in the presence of 0.1 to 3.0 mol% amino acid solutions were determined in the range of 273.05 to 281.45 K and 14.1 to 35.2 bar. From quantitative analyses, the inhibiting effects of the amino acids on a mole concentration basis decreased in the following order: L-valine > L-alanine > glycine. However, the inhibiting effects of the amino acids on a weight concentration basis have the opposite order: glycine > L-alanine > L-valine. According to the analyses, it was concluded that thermodynamic inhibition mechanism of CO_2 hydrate formation is driven by both "hydrogen bond" and "hydrophobic effect". These kind of fundamental understandings on thermodynamic inhibition of is expected to give us a meaningful insight to desgin better THIs.