Physical properties of metal precursors in the bulk and nano spaces for design of supercritical fluid deposition processes

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The deposition of metal particles on porous supports using supercritical CO_2 has attracted much attention as a method for preparing supported catalysts because the metal particles can be dispersed in the pore structure. Physical properties of metal precursors in the bulk and nano spaces in supercritical CO_2 are important to efficiently design the supported catalyst using the supercritical CO_2 deposition method.

In this study, therefore, the solubility (bulk space) and adsorption equilibria (nano space) of metal precursors onto mesoporous materials in supercritical CO_2 were investigated. A thermodynamic model using the PC-SAFT (perturbed-chain statistical associating fluid theory) equation of state was applied to predict the solubility of various acetylacetonate-type metal precursors in supercritical CO_2. The adsorption equilibria of the metal precursors onto mesoporous silica materials in supercritical CO_2 were also measured and modeled using a thermodynamic adsorption model. The models could reproduce the physical properties in supercritical CO_2, which can be useful for designing the supercritical fluid deposition processes.