Phase Behavior of Liquid and Gaseous Fluids in Lyophilic and Lyophobic Porous Media

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The results of calorimetric investigations of phase behavior of liquid and gaseous hydrocarbons in lyophilic (wettable) and lyophobic (non-wettable) porous media are presented. Quartz powders are used as lyophilic porous media for hydrocarbons. Lyophilic properties of quartz powders are manifested through increased capillary condensation as well as sorption of hydrocarbons. As a result the phase diagrams of hydrocarbons in lyophilic porous media are transformed in compare with bulk diagrams. Quartz powders covered with water film are used as lyophobic porous media for hydrocarbons. Quartz powders covered with thin water film are lyophilic or lyophobic depends on the length of n-alkane's molecule (with increasing of hydrocarbon chain the lyophobic properties of water film are increasing). Ethane wets water surface completely. Propane and i-butane wet the water surface completely or partially depending on specified conditions. Heavier alkanes wet the water surface partially (mostly non-wetting). Due to the lyophobic surface of water the capillary effect for evaporation of liquid hydrocarbons is take place. Evaporation of liquid hydrocarbon (propane, for example) occurs at pressure above the saturation vapor pressure of this hydrocarbon in bulk due to a curvature and non-wettability of water surface. The result of this effect is a shift of the vapor - liquid equilibrium line of hydrocarbon in the quartz powder covered with water film in compare with the bulk equilibrium line. Transformation of hydrocarbon phase behavior affects on the gas hydrate transition that is manifested through the hydrate upper quadruple point shift into the higher temperature and pressure. The result of this shift is expansion of the gas hydrate stability field and possibility of existence of the state of “superheated" gas hydrates.