2043. Applied Thermodynamics of Mixtures

Mixture definition. Homogeneous and heterogeneous mixtures. Gibbs phase rule. free enthalpy of Gibbs and relation to other thermodynamic mixtures. Ideal and non-ideal mixtures. Ideal mixtures and Raoult's law. Specific volatility of ideal mixture. VLE equilibrium diagrams of ideal mixtures. Trouton's rule. Statistical determination of entropy and free enthalpy of mixing in ideal mixtures. Energy balance and entropy changes in gaseous mixtures of ideal gases.

Non-ideal mixtures. Properties of excess of free enthalpy, enthalpy, and entropy. Thermodynamic classification of mixtures. Partial molar properties. Activity coefficients and deviation from Raoult's law. Relative volatility of non-ideal mixtures. Isothermal p–x diagrams and isobaric T–x equilibrium diagrams. Classification of mixtures based on p–x equilibrium diagrams. Azeotropic mixtures. Description of the UNIFAC statistical method for determining activity coefficients.

Thermodynamic analysis of binary mixture processes. Heat of mixing. Heat of vaporization. Construction, interpretation, and use of composition-enthalpy diagrams. Graphical and analytical representation of processes (mixing, vaporization, throttling, absorption). Description of the operation of ammonia-water refrigeration systems. Description of LiBr-H_2O refrigeration systems.

Methods of binary mixtures separation. Enrichment-depletion units. Study of enrichment-depletion columns using the McCabe-Thiele approximate method and the Ponchon exact method..

(T. Roumpedakis)