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The two-phase state of chemicals under studied and unstudied conditions

Anatoly I Vitvitskiy
FSUE RSC Applied Chemistry, Russia

Statement of the Problem: The two-phase state of chemicals in the systems crystal-gas (cr-g) and liquid-gas (l-g) is characterized by the equilibrium pressure (saturated vapor pressure) – P_p (Pa) at the temperature T (K). The results of the research are usually reference table data, as the thermodynamic concepts do not allow describing in one equation the whole investigated region of the equilibrium parameters.

Methodology & Theoretical Orientation: The equilibrium parameters P_p and T, are presented in coordinates ln (P_pT) – 1/T, forms a straight logarithmic, which corresponds to the exponential dependence $P_p = (P_mT_m/T)$ exp (1 – Tm/T), where T_m is the temperature, which determines the slope of the logarithmic straight and their upper limit in the systems cr-g or l-g; $P_p = P_m$ at $T = T_m$.

Findings: Discovered that the heat of formation of one mole of a gaseous substance from a liquid or solid state - Q (J/ (mol K)) related to the temperature by Q = R $(T_m - T)$ = Q_m – RT, where R = 8.314 J/ (mol•K) is the universal gas constant; Qm = RTm. Both equations are applicable in the temperature range $0<T<T_m$; at $T = T_m$ and $P_p = P_m$, Q = 0; at T→0, P_p→0 and Q tends towards value Qm.

Conclusion & Significance: The equation with two individual semi-empirical parameters Tm and Pm describes the two-phase equilibrium state of chemicals not only in the studied conditions, but also in the field of superheated crystals (system cr-g at T above the temperature of the triple point), supercooled liquid (system l-g at T below the temperature of the triple point) and supercritical fluids (system l-g at T above the critical temperature).

avitvitskiy@mail.ru

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