

The Isobaric Heat Capacity of Ethanol + Water Solutions

E.I. Hanifayeva, M.A. Talybov, A.N. Shahverdiyev^{C,S}

Heat and Refrigeration Techniques, Azerbaijan Technical University, Baku, Azerbaijan
ozone@azdata.net

The isobaric heat capacity of liquid ethanol + water solutions was measured in a facility utilizing the method of a pulsed – regular mode. The experiments were carried out for the ethanol + water solutions in the temperature range $T=298.15$ to 523.15 K, at mole fractions of ethanol of $x=0.20$, $x=0.50$, $x=0.60$, $x=0.80$ and up to 50 MPa.

The dried ethanol from “Merck” company (Germany) was used in the experiments. The mass fraction of the ethanol was $w \geq 0.998$. Double distilled water was used for the preparation of the solutions.

The isobaric heat capacity was calculated from the experimental data using the equation from Ref. [1]:

$$c_p' = \frac{1}{V(1 + \frac{2\delta}{3R_1} + \frac{2\delta'}{3l})} \cdot \left[\frac{W(1-k)}{b_0} - \mu_\delta c_\delta \right]$$

where c_p' is the volumetric isobaric heat capacity, J/(m³K); V is the volume of the material to be investigated in the ampoule, m³; $k = W_{\text{loss}}/W$ is the coefficient allowing for heat losses; W is the capacity of the inner heater, Wt; W_{loss} is the necessary correction for heat losses; $b_0 = [1 + 1/12(\Delta t^2/\theta_{\text{max}}^2)]$ is the heating at a given temperature, K/s; $b = \Delta t/\Delta \tau$; θ_{max} is the maximum temperature drop in the annular layers of liquid, which are located between the cylindrical ampoule and the inner wall of the body respectively, and R_1 and l are the ampoule radius and length, m.

Test measurements for water and benzene [2] have shown that the maximum error of experimental data in the investigated range of parameters is 2.2%.

On the basis of the experimental c_p' values and density ρ values from ref. [3], the thermal capacity, mass isobaric c_p was calculated.

[1] Y.M. Naziyev, *Inzh-Fiz. Zh.* **51** (4), 613 (1986).

[2] Y.M. Naziyev, M.M. Bashirov, and Y.A. Badalov, *Inzh-Fiz. Zh.* **51** (5), 789 (1986).

[3] E.I. Hanifayeva, *Density of aqueous ethanol solutions*, Preprints of Scientific Conference of AzTU, Baku, 2005, 181-185.