

20. ZADATAK

Procijeniti kritični tlak smjese etana(1) i benzena(2) sastava $y_1=0,392$ Kreglewski-Kayevim postupkom

Eksperimentalno određeni kritični parametri smjese iznose: $p_{KM}=83,8$ atm; $T_{KM}=499,1$ K

Termodinamički podaci

TVAR	ETAN	BENZEN
T_K/K	305,4	562,1
p_K/atm	305,4	48,3
$v_K/cm^3 mol^{-1}$	148	259
$v^*/cm^3 mol^{-1}$	54,87	93,97
ω	0,098	0,212

$v(T_r=0,60)$

Empirijski izraz za procjenu kritičnoga tlaka

$$p_{\text{KM}} = p^* \left[1 + (5,808 + 4,93\omega) \left(\frac{T_{\text{KM}}}{T^*} - 1 \right) \right]$$

Izračunavanje potrebnih veličina

$$v^* = y_1 v_1^* + y_2 v_2^* + (2v_{12}^* - v_1^* - v_2^*) y_1 y_2$$

$$v_{12}^* = \frac{\left[(v_1^*)^{1/3} + (v_2^*)^{1/3} \right]^3}{8} = 72,7 \text{ cm}^3 \text{ mol}^{-1}$$

$$v^* = 77,8 \text{ cm}^3 \text{ mol}^{-1}$$

$$\theta_1 = \frac{y_1 (v_1^*)^{2/3}}{y_1 (v_1^*)^{2/3} + y_2 (v_2^*)^{2/3}} = 0,310$$

$$\theta_2 = 1 - \theta_1 = 0,690$$

Osrednjenje
linearne dimenzije

Površinski udio?

$$T^* = (v_1^*)^{1/3} \left\{ \frac{T_{\text{K1}} \theta_1}{(v_1^*)^{1/3}} + \frac{T_{\text{K2}} \theta_2}{(v_2^*)^{1/3}} + \left[\frac{2T_{12}^*}{(v_{12}^*)^{1/3}} - \frac{T_{\text{K1}}}{(v_1^*)^{1/3}} - \frac{T_{\text{K2}}}{(v_2^*)^{1/3}} \right] \theta_1 \theta_2 \right\}$$

$$T_{12}^* = \frac{2(v_{12}^*)^{1/3}}{(v_1^*)^{1/3} / T_{\text{K1}} + (v_2^*)^{1/3} / T_{\text{K2}}} = 406 \text{ K}$$

$$T^* = 462 \text{ K}$$

Temperaturni parametar

$$T_{\text{KM}} = \varphi_1 T_{\text{K1}} + \varphi_2 T_{\text{K2}}$$

$$\varphi_1 = \frac{y_1 v_{\text{K1}}}{y_1 v_{\text{K1}} + y_2 v_{\text{K2}}} = \frac{0,392 \cdot 148}{0,392 \cdot 148 + 0,698 \cdot 259} = 0,269$$

$$\varphi_2 = 1 - \varphi_1 = 0,731$$

$$T_{\text{KM}} = 0,269 \cdot 305,4 + 0,731 \cdot 562,1 = 493 \text{ K}$$

Eksperiment: $T_{\text{KM}} = 499 \text{ K}$

Pseudokritična temperatura, (kritični) volumni udio!

$$p^* = \frac{T^*}{(v_1^*)^{1/3}} \frac{p_{\text{K1}} \theta_1 + p_{\text{K2}} \theta_2}{T_{\text{K1}} / (v_1^*)^{1/3} + T_{\text{K2}} / (v_2^*)^{1/3}} = 47,4 \text{ atm}$$

Tlačni parametar

$$\omega_{\text{M}} = \omega_1 \theta_1 + \omega_2 \theta_2 + (2\omega_{12} - \omega_1 - \omega_2) \theta_1 \theta_2 = 0,167$$

$$\omega_{12} = \frac{2}{1/\omega_1 + 1/\omega_2} = 0,134$$

Pitzerov koeficijent acentričnosti za smjesu

$$\begin{aligned} p_{\text{KM}} &= p^* \left[1 + (5,808 + 4,93\omega) \left(\frac{T_{\text{KM}}}{T^*} - 1 \right) \right] = \\ &= 47,4 \left[1 + (5,808 + 4,93 \cdot 0,167) \left(\frac{493}{462} - 1 \right) \right] = \\ &= 68,5 \text{ atm} \end{aligned}$$

Eksperiment:

$$p_{\text{KM}} = 83,8 \text{ atm}$$