$T_o := 273.15 \cdot K$ $R_g := 1.98 \frac{cal}{mole \cdot K}$

$T_{BP\_1} := 352.8 \cdot K$ $\Delta H_{V\_1} := 32.0 \cdot 10^3 \cdot \frac{J}{mole}$ MEK $\Delta Z_1 := 1$

$T_{BP\_2} := 383.2 \cdot K$ $\Delta H_{V\_2} := 37.79 \cdot 10^3 \cdot \frac{J}{mole}$ Toluene $\Delta Z_2 := 1$

$$\frac{d}{dT} \ln(P_{sat}) = \frac{\Delta H_V(T)}{\Delta Z \cdot R_g \cdot T^2}$$

Clapeyron Equation
assume $\Delta H_V(T)$ is constant

Eq. 6.73
p. 221

$$P_{1\_sat}(T) := 1 \cdot atm \cdot \exp\left[\frac{-\Delta H_{V\_1}}{\Delta Z_1 \cdot R_g} \cdot \left(\frac{1}{T} - \frac{1}{T_{BP\_1}}\right)\right]$$ $P_{1\_sat}(T_{BP\_1}) = 1.013 \times 10^5 \, Pa$

$$P_{2\_sat}(T) := 1 \cdot atm \cdot \exp\left[\frac{-\Delta H_{V\_2}}{\Delta Z_2 \cdot R_g} \cdot \left(\frac{1}{T} - \frac{1}{T_{BP\_2}}\right)\right]$$ $P_{2\_sat}(T_{BP\_2}) = 1.013 \times 10^5 \, Pa$

Partial Pressures of Binary Mixture

$$P_1(x_1, T) = y_1 \cdot P = \gamma_1(x_1) \cdot x_1 \cdot P_{1\_sat}(T)$$ Eq. 12.11

$$P_2(x_1, T) = y_2 \cdot P = \gamma_2(x_1) \cdot x_2 \cdot P_{2\_sat}(T)$$

$A_{12} := 0.372$

$A_{21} := 0.198$

MEK/Toluene
p 438

Margules Equations

$$\gamma_1(x_1, T) := \exp\left[(1 - x_1)^2 \cdot \left[A_{12} + 2 \cdot (A_{21} - A_{12}) \cdot x_1\right]\right]$$ Eqs 12.10 a and b

$$\gamma_2(x_2, T) := \exp\left[(1 - x_2)^2 \cdot \left[A_{21} + 2 \cdot (A_{12} - A_{21}) \cdot x_2\right]\right]$$

$$P_1(x_1, T) := \gamma_1(x_1, T) \cdot x_1 \cdot P_{1\_sat}(T)$$

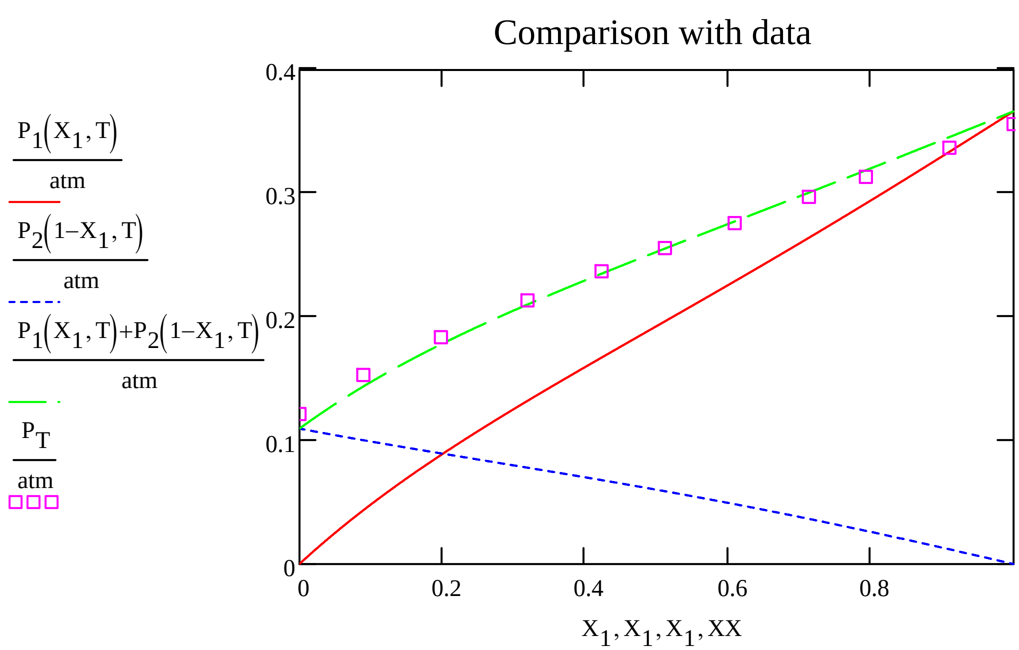
$$P_2(x_2, T) := \gamma_2(x_2, T) \cdot x_2 \cdot P_{2\_sat}(T)$$

$P_2(1, T_o) = 839.872 \, Pa$

$$\text{Data} := \begin{pmatrix} 12.3 & 0 \\ 15.51 & 0.0895 \\ 18.61 & 0.1981 \\ 21.63 & 0.3193 \\ 24.011 & 0.4232 \\ 25.92 & 0.5119 \\ 27.96 & 0.6096 \\ 30.12 & 0.7135 \\ 31.75 & 0.7934 \\ 34.15 & 0.9102 \\ 36.09 & 1 \end{pmatrix}$$

$P_T := \text{Data}^{\langle 0 \rangle} \cdot 10^3 \cdot \text{Pa} \quad XX := \text{Data}^{\langle 1 \rangle}$

$T := 50 \cdot K + T_o$



$ORIGIN := 1$

$$\Delta H := \begin{pmatrix} 31.3 \\ 37.79 \\ 1000 \end{pmatrix} \cdot 10^3 \cdot \frac{J}{mole} \qquad T_{BP} := \begin{pmatrix} 352.8 \\ 383.95 \\ 500 \end{pmatrix} \cdot K \qquad \Delta Z := \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \qquad A := \begin{pmatrix} 0 & 0.198 & 0 \\ 0.198 & 0 & 0.372 \\ 0 & 0.372 & 0 \end{pmatrix}$$

$$Psat(k,T) := 1 \cdot atm \cdot \exp\left[\frac{-\Delta H_k}{\Delta Z_k \cdot R_g} \cdot \left(\frac{1}{T} - \frac{1}{T_{BP_k}}\right)\right]$$

$$Psat\left(1, T_{BP_1}\right) = 1\ atm$$

$$Psat\left(2, T_{BP_2}\right) = 1\ atm$$

Partial Pressures of Multicomponent Mixture

$$P_i\left(x_i, T\right) = y_i \cdot P = \gamma_i\left(x_i\right) \cdot x_i \cdot P_{i\_sat}(T)$$

Margules Equations

$$\ln\left(\gamma_k\right) = \sum_{i=1}^{N} \sum_{j=1}^{N} \left[\left(\frac{a_{i,k}}{RT} - \frac{a_{i,j}}{2 \cdot RT}\right) x_i \cdot x_j\right]$$

$$\frac{a}{RT} = A$$

$$\gamma(k,x) := \exp\left[\sum_{i=1}^{3} \sum_{j=1}^{3} \left[\left(A_{i,k} - \frac{A_{i,j}}{2}\right) \cdot x_i \cdot x_j\right]\right]$$

$$p(k,x,T) := \gamma(k,x) \cdot x_k \cdot Psat(k,T)$$

$$x := \begin{pmatrix} 0.3 \\ 0.6 \\ 0.1 \end{pmatrix} \qquad \begin{pmatrix} \text{MEK} \\ \text{Toluene} \\ \text{Resin} \end{pmatrix}$$

Binary Results for Comparison

$p(1, x, T_o) = 1.425 \times 10^3\ \text{Pa}$ MEK

$P_1(0.3, T_o) = 1.426 \times 10^3\ \text{Pa}$

$p(2, x, T_o) = 511.745\ \text{Pa}$ Toluene

$p(3, x, T_o) = 0\ \text{Pa}$ Resin