**Relative volatility:**

The relationship between the composition of the vapour *yA* and of the liquid *xA* in equilibrium may also be expressed in a way, which is particularly useful in distillation calculations. If the ratio of the partial pressure to the mole fraction in the liquid is defined as the volatility, then:

αA =PA˚ / PT , α B=PB˚ / PT and the αAB = αA / α B= PA˚ / PB˚ then

αAB = (yA / XA ) / (yB / XB ) therefore yA = αAB XA / ( 1+ XA (αAB -1)) or

XA = yA / αAB- (αAB -1) yA

Example

The following vapour pressure data for the system hexane- octane

T,C˚ 68.7 79.4 93.3 107.2 125.7

PA˚ , mmHg 760 1025 1480 2130 3420

PB˚ , mmHg 121 173 278 434 760

1. Using the Raoults law for calculating and pot the x, y data at total pressure of 101.3kpa (760mmHg)
2. Plot the poling point diagram
3. Calculate the relative volatility for n-hexane, n-octane

Solution

1. At T= 68.7 C˚ then XA = PT-PB˚ / PA˚ -PB˚  = 760-121 / 760-121= 1

yA= XA \* PA˚  / PT = 1\* 760 / 760 = 1 , αA =PA˚ / PT  =760/ 760=1

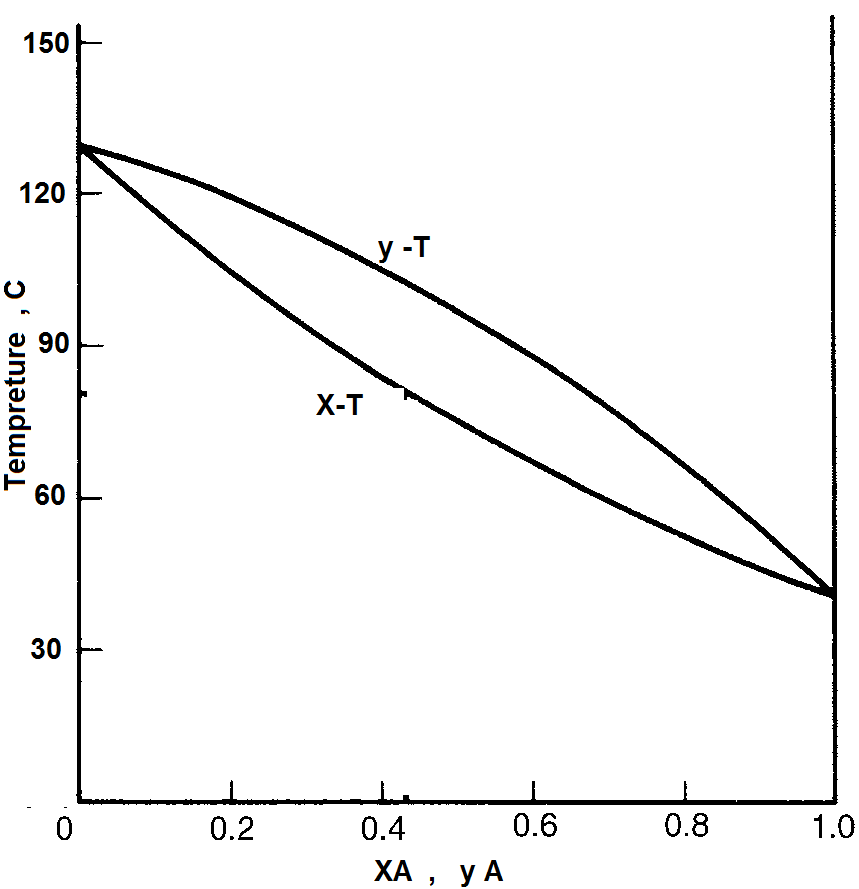
α B=PB˚ / PT =121 / 760 = 0,159 , αAB = αA / α B= PA˚ / PB˚ = 760 / 121 = 6.28

At T = 79.4 C˚ then XA = 760-173 / 1025-173 = 0.68 and

yA = 0.68\* 1025 / 760 = 0.92 , αA =PA˚ / PT = 1025 / 670 = 1.34

α B=PB˚ / PT = 173 / 760 = 0.227 , αAB = αA / α B= PA˚ / PB˚  =1025 / 173 =5.92

1. Boling point diagram



C)

T, C˚ XA yA αA αB αAB

68.7 1 1 1 0.159 6.238

79.4 0.68 0.92 1.34 0.227 5.9

93.3 0.4 0.78 1.94 0.365 5.3

107.2 0.19 0.53 2.8 0.57 4.9

125.7 0 0 4.5 1 4.5