Lecture 7: Property tables, ideal and real gases.

1. Demonstrate EES from ppt Lec.6.
2. Teamplay ppt Lec.7. Slide 3.

Quality:

Fraction of a mixture in vapor phase.

\[ x = \frac{m_g}{m_g + m_f} = 1 - \frac{m_f}{m_g + m_f} \]

Also, fraction of distance along the saturation line in \( P-v \) or \( T-v \) diagram:

Proof: \[ v = \frac{V}{m} \Rightarrow v_{av} = \frac{v_f + v_g}{m_f + m_g} = \frac{m_f v_f + m_g v_g}{m} \]

\[ x = \frac{m_g}{m_f} = 1 - \frac{m_f}{m} \Rightarrow m_g = m x \quad m_f = m (1-x) \]

\[ v_{ar} = \frac{m'(1-x) v_f + m' x v_g}{m'} \]
\[ u_{av} = u_f + x(v_g - v_f) \]

Solve for \( x \):
\[ x = \frac{u_{av} - u_f}{v_g - v_f} \]

we give \( v_g - v_f \) the special name \( v_{fg} \)

\[ x = \frac{u_{av} - u_f}{v_{fg}} \]

**Internal Energy:**

The intensive internal energy is also listed in the saturation tables:

\[ u = \frac{U}{m} \]

The quality can also be used find the internal energy of mixtures:

\[ u = u_f + x(v_g - u_f) \]

**Enthalpy:**

Important, new thermodynamic property:

\[ H = U + pV \]

\[ Nm; \frac{N}{m^2} \cdot m^3 \]
Intensive Enthalpy:

\[ \frac{H}{m} = \frac{U}{m} + P \frac{V}{m} \]

\[ h = u + v \]

The quality can also be used to find the enthalpy of mixtures:

\[ h_{av} = h_f + x (h_g - h_f) \]

Property diagrams:

P-v or T-v diagrams always have v on the x-axis (abscissa). This is the opposite naming convention to the x-y plane.

Teamplay: label the states. Identify the tables for H_2O.

Table A-6

Table A-4, 5

Interpolation:

known

\[ x_1 \quad y_1 \]
\[ x_2 \quad y_2 \]

sought:

\[ y = f(x) ; \quad x_1 < x < x_2 \]

\[ y = \frac{x - x_2}{x_1 - x_2} y_1 + \frac{x - x_1}{x_2 - x_1} y_2 \]
Go to ppt Lec. 7 slide 14 - 19
Is the following process possible?
If so, how?
What is the initial state?
" " final state?
Is there heat transfer with the surroundings?

Any process is possible.
Refrigerant 134a:

Teamplay: label the phases and identify the tables.

Do teamplays on ppt: Lec. 7 slides 23-24.

Ideal Gas Law:

\[ P \cdot V = n \cdot R \cdot T \]

\[ R = \frac{E_u}{M_m} \]

\( E_u \) = molar mass.