FLUID PROPERTIES

Specific Heat Capacity

The term originated primarily through the work of Scottish physicist Joseph Black

Specific Heat at Constant Volume= C_V

Is defined as the Amount of Heat required to raise the unit mass of a given substance by one degree at constant volume.

Specific Heat at Constant Pressure= C_p

Is defined as the Amount of Heat required to raise the unit mass of a given substance by one degree at constant pressure.

FLUID PROPERTIES

Specific Internal Energy (u) / (J/kg K)

The energy that a substance posses because of the state of molecules in the substance.

For an ideal gas the specific internal energy - *u* - is a function of temperature and the change in internal energy can be expressed as

$$du = C_V dT \qquad (1)$$

where

du = change in internal energy

cv = specific heat capacity for the gas in a constant volume process

dT = change in temperature

***cv* varies with temperature, but within a moderate temperature change the heat capacity - *cv* - can be regarded as constant.**

FLUID PROPERTIES

Specific Enthalpy (h) / (J/kg K)

For an ideal gas the specific enthalpy - h - is function of temperature and the change in enthalpy can be expressed as

$$dh = C_p dT \qquad (2)$$

where
dh = change in enthalpy
cp= specific heat capacity for the gas in a constant pressure process
cp can within a moderate temperature change be regarded as constant.

More about Specific Heat Capacities for Gases
The enthalpy in a fluid is defined as:

$$h = u + \frac{p}{\rho} \qquad (3)$$

FLUID PROPERTIES

where
h = Enthalpy
u = Internal energy
p = Absolute pressure
ρ = Density

Combining (3) and the Ideal Gas Law gives:

$$h = u + R\,T \qquad (4)$$

where
R = the individual gas constant
The change in enthalpy can be expressed by differentiating (4):

$$dh = du + R\,dT \qquad (5)$$

Dividing (5) with dT gives:

$$(dh / dT) - (du / dT) = R \qquad (6)$$

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Modifying (6) with (1) and (2):

$$cp - cv = R \qquad (7)$$

The difference cp - cv is constant for an ideal gas.

The Ratio of Specific Heats

The Ratio of Specific Heats can be expressed as:

$$k = cp / cv \qquad (8)$$

Where:
k = the ratio of specific heats

END of Lecture (2)