One who asks a question fearlessly,

For a moment he may feel miserable,

One who dares not to ask questions,

He remains as a fool year after year.

-Dr. D.P. Mishra

Previous Next

Module 2: Thermodynamics of Combustion

Lecture 6: Introduction

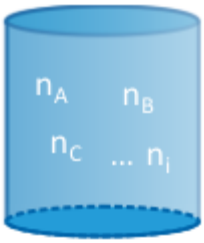
The Lecture Contains:

Previous Next

Thermodynamics of Combustion

Introduction

Dalton's Law of Partial Pressure



Container containing gas mixture

(Figure 6.2)

Total no of moles, $n_{tot} = n_A + n_B + n_C + \ldots n_i$ ..... (1)

Dividing by n_{tot} ,

$1 = X_A + X_B + X_C + \ldots + X_i = \Sigma X_i$

Where, X_A, X_B are mole fraction of species A, B,..

Total mass of the mixture, m_{tot}

$m_{tot} = m_A + m_B + m_C + \ldots + m_i$

Dividing by m_{tot},

$1 = Y_A + Y_B + Y_C + \ldots + Y_i = \Sigma Y_i$

Where, Y_A, Y_B are mass fraction of species A, B, ..

$Y_i = m_i/m_{mix} = n_i MW_i/nMW_{mix} = X_i MW_i/MW_{mix}$

$MW_{mix} = \Sigma X_i MW_i$ = Molecular weight of mixture

$MW_{mix} = 1/\Sigma Y_i/MW_i$

Also, from ideal gas law, $n = PV/R_u T$

Substituting in (1),

$$P = (n_A R_u T/V) + (n_B R_u T/V) + (n_C R_u T/V) + \ldots + (n_i R_u T/V) = p_A + p_B + p_C \ldots + p_i = \Sigma p_i$$

Previous Next

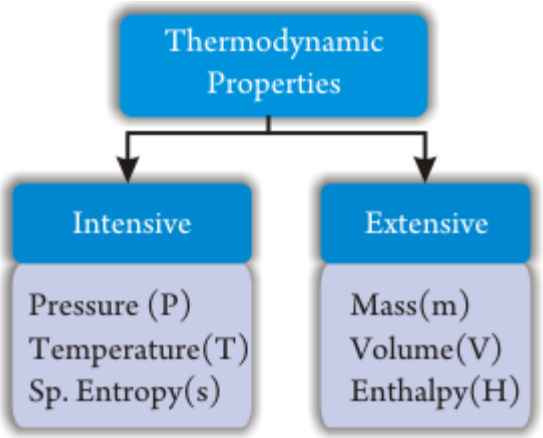
Gas Mixture

Dalton's Law	Total pressure of a gaseous mixture is sum of the pressure which each component would exert if it alone occupies the same volume and temperature of mixture.
Gibb's Theorem	Internal energy of a mixture of ideal gases is equal to the mole/mass fraction weighed sums of the internal energy of individual components of mixture.

Gibbs- Dalton law : Employed to extract properties of mixture from individual gases
Gibbs Theorem : Specific molar internal energy of the mixture from the constituent species

Previous Next

Thermodynamic Properties



(Figure 6.1)