Asking a question is not the end of a thing,

One can assume it to be a humble beginning,

If explored earnestly without bothering,

One can definitely have a happy ending.

-Dr. D.P. Mishra

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Module 4: Chemistry of combustion

Lecture 18: Introduction

The Lecture Contains:

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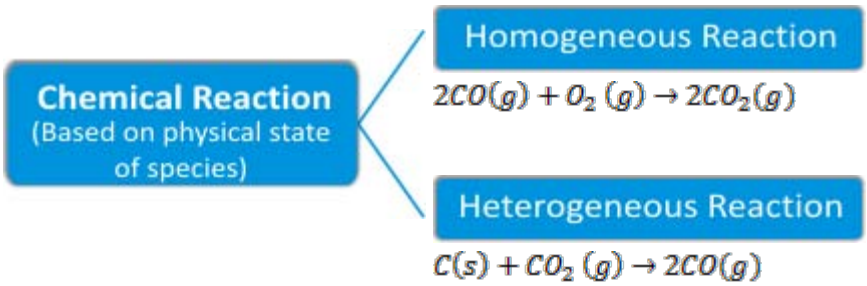
Chemistry of combustion

Introduction

Chemical kinetics:

The specialized branch of physical chemistry dealing with the study of chemical reactions and their governing factors.



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Basic Reaction Kinetics

Reaction rate:

Rate of decrease of reactant concentration or rate of increase of product concentration. Expressed in terms of **mole/m^{3}s**

Compact expression for chemical reaction:

$$\sum_{i=1}^{N} v_i' M_i \rightarrow \sum_{i=1}^{N} v_i'' M_i$$

Where, v_i' and v_i'' are stoichiometric coefficients of reactants and products.

N is the total number of species

M is the arbitrary specification of all chemical species

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Expressing the reaction using index notation:

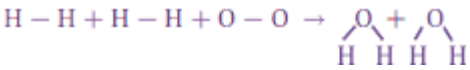
$3H \rightarrow H_2 + H$			$H + O_2 \rightarrow HO_2$		
Here, N=2			Here, N=3		
$M_1 = H$	$M_2 = H_2$		$M_1 = H$	$M_2 = O_2$	$M_3 = HO_2$
$v_1' = 3$	$v_2' = 0$		$v_1' = 1$	$v_2' = 0$	$v_3' = 0$
$v_1'' = 1$	$v_2'' = 1$		$v_1'' = 0$	$v_2'' = 0$	$v_3'' = 1$

Note: The above reactions are elementary in nature

Global reactions,

$2H_2 + O_2 \rightarrow 2H_2O$

3 bonds have to be broken,
4 bonds have to be formed



Unlikely to occur!!

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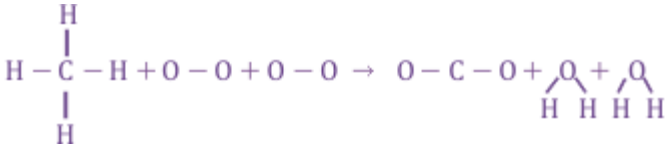
Global reactions,

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$



Bimolecular reactions

Reaction between two molecules,

$$aA + bB \rightarrow cC + dD$$

$$RR = -\frac{1}{a}\frac{dC_A}{dt} = -\frac{1}{b}\frac{dC_B}{dt} = \frac{1}{c}\frac{dC_C}{dt} = \frac{1}{d}\frac{dC_D}{dt}$$

$$H + O \rightarrow OH \qquad RR_H = \frac{dC_H}{dt} \propto C_H C_O$$

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