

ME 662 Combustion (3-0-0-6)

Combustion Modes and Flame Types; Combustion and Thermochemistry: Property relations, First law of thermodynamics, Reactant and product mixtures, Adiabatic flame temperature, Chemical equilibrium, Equilibrium products of combustion; Introduction to Mass Transfer: Mass transfer rate laws, Species conservation, The Stefan problem, Liquid-vapor interface boundary conditions, Droplet evaporation; Chemical Kinetics: Global versus elementary reactions, Elementary reaction rates, Rates of reaction for multistep mechanisms; Some Important Chemical Mechanisms: The H₂-O₂ system, Carbon monoxide oxidation, Oxidation of higher paraffins, Methane combustion; Oxides of nitrogen; Coupling Chemical and Thermal Analysis of Reacting Systems: Constant-pressure fixed mass reactor, Constant-volume fixed mass reactor, Well-stirred reactor, Plug-flow reactor; Conservation Equations for Reacting Flows: Overall mass conservation, Species conservation; Multicomponent diffusion; Momentum conservation, Energy conservation, The concept of a conserved scalar; Laminar Premixed Flames: Physical description, Simplified analysis, Detailed analysis, Factors influencing flame velocity and thickness, Quenching, flammability and ignition, Flame stabilization; Laminar Diffusion Flames: Nonreacting constant density laminar jet, Jet flame physical description, Simplified theoretical descriptions, Soot formation and destructions, Counter flow flames; Pollution Emissions: Effects of pollutants, Quantifications of emissions; Emissions from premixed combustions, Emission from nonpremixed combustion.

Textbook:

1. S. R. Turns, *An Introduction to Combustion*, 2nd Ed, McGraw Hill, 2000.

References:

1. J. Warnatz, U. Mass and R. W. Dibble, *Combustion*, 3rd Ed, Springer, 2001.
2. F. A. Williams, *Combustion Theory*, 2nd Ed, Addison Wesley Publishing Company, 1985.
3. K. K. Kuo, *Principles of Combustion*, 2nd Ed, Wiley-Interscience, 2005.