Mass Transfer

Text: Fundamentals of Momentum, Heat and Mass Transfer, 3rd Ed.
by J.R. Welty, C.E. Wicks and R.E. Wilson, Wiley (1984), ISBN:0-471-87497-3
References: 1. An Introduction to Mass and Heat Transfer by S. Middleman (1998)
2. Transport Phenomena by BSL (1960)

Goal of understanding mass transfer;

~ Mathematical models for chemical engineering process involving mass transfer system
- Basic principles (conservation law, Fick's law, et al.)
- Rate equations & Empirical equations

~ Knowledge of basics
- Multi-component system and binary or more species: concentration
- Thermodynamics and phase equilibria: chemical potential, enthalpy, activity coefficient, distribution coefficient, and partial molar property
- Transport phenomena: mass balance, diffusion and convection

Mass transfer system;

~ Multi-component system 의 농도차가 지역적으로 있는 경우에 농도구배 또는 농도차를 최소화하는 전달현상 또는 전달메카니즘

Driving forces of mass transfer
- concentration gradients
- electrical potential gradients
- pressure gradients
- centrifugal fields

Examples of mass transfer process;
- coffee, perfume, water evaporation and humidity
- removal of pollutants, stripping of gases, neutron diffusion within nuclear reactor chemical/biological reaction
- multi-component distillation, absorption, extraction, evaporation and condensation
- heterogeneous catalyst, ion exchange and adsorption
- sedimentation and ultracentrifugation
- electrolysis, dialysis, electrodialysis
- filtration, membrane gas separation, pervaporation, reverse osmosis, ultrafiltration

Mechanism of mass transfer; minimizing concentration differences
- diffusion : mass transfer by molecular movement
- convection : mass transfer by bulk motion of multi-component fluids
- dispersion : mass transfer by rapid motion of multi-component fluids