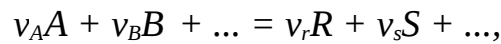


Physical and chemical bases of chemical processes. Stoichiometry, thermodynamics, kinetics of chemical reactions. Classification of chemical processes. Homogeneous, heterogeneous chemical processes. The essence and importance of optimizing the physico-chemical conditions of chemical and technological processes. Mathematical modeling of chemical-technological processes

The stoichiometric equation shows the ratios of substances that enter into chemical interaction. General view of the stoichiometric equation is:



where A, B, \dots are the starting materials; R, S, \dots - products; $v_A, v_B, v_R, v_S, \dots$ are the stoichiometric coefficients.

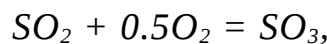
The stoichiometric equation establishes the ratio between the amount of converted substances:

$$(N_{A0} - N_A) / v_A = (N_{B0} - N_B) / v_B = (N_R - N_{R0}) / v_R = (N_S - N_{S0}) / v_S,$$

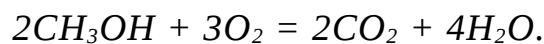
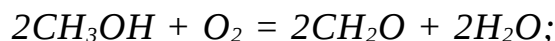
where $N_{A0}, N_{B0}, N_{R0}, N_{S0}$ is the initial amount of components A, B, R, S ; and N_A, N_B, N_R, N_S is the amount of the same components after transformation; $(N_{A0} - N_A), (N_{B0} - N_B)$ is the amount of the converted initial substances A and B ; $(N_R - N_{R0}), (N_S - N_{S0})$ is the amount of R and S products formed.

A *simple reaction* is described by one stoichiometric equation, a *complex reaction* is described by several equations.

An example of a simple reaction is the oxidation of sulfur dioxide:



An example of a complex reaction is methanol oxidation:



Processes of chemical technology, depending on the kinetic regularities characterizing their course are divided into five groups:

- *hydromechanical processes* which speed is defined only by laws of hydraulics;
- *thermal processes*, the speed of which is determined by the laws of heat transfer;
- *mass transfer (diffusion) processes*, the speed of which is determined by the laws of mass transfer;
- *mechanical processes*;
- *chemical processes*, the rate of which is determined by the laws of chemical kinetics (catalytic).

Hydromechanical processes are: sedimentation, filtration, fluidization, mixing in the liquid phase.

Thermal processes are: heating, cooling, condensation, evaporation, heat transfer.

Mass transfer processes are: adsorption, absorption, rectification, extraction, drying.

Extraction proceeds in extractors of different designs are: mixing and settling; column; centrifugal and pulsation.