other parameters of the electrochemical system by an equation. Knowing this pattern, you can consciously adjust the speed of the studied electrode processes.

Electrode processes are heterogeneous, and therefore consist of a series of successive stages. The total speed of the electrode process under these conditions is determined by the speed of the slowest stage. This means that the total velocity value is the sum of the velocity values for different stages: the slowest stage for a given *i* will give the largest velocity component, in comparison with which other velocity components are neglected.

Electrochemical processes are called chemical-technological processes in which the energy of an electric current is spent on the implementation of chemical transformations and as a result is converted into chemical energy.

In chemical technology, electrochemical processes are used to produce:

- halogens;
- alkalis;
- oxygen and hydrogen by electrolysis of water;
- inorganic oxidizers: permanganate, hydrogen peroxide, chlorates, perchlorates, persulfates, hypochlorites, etc.;
- lithium, sodium, potassium, magnesium, aluminum, chromium, etc.;
- non-ferrous metals (zinc, copper, nickel, silver, etc.) by refining;
- alcohols, aldehydes, ketones by anodic oxidation;
- nitro derivatives of nitrogen-containing compounds by cathodic reduction;
- electroplating-application, production and reproduction of metal copies of protective coatings from non-ferrous metals;
- electrotypes.

Advantages of electrochemical processes:

- simplicity of the hardware design of the technology and low-step process;
- high utilization of raw materials and energy;
- simultaneous production of several target products from one raw material;
- high purity of products;
- the ability to perform transformations and produce products that are not available when using purely chemical methods.

The main drawback of these processes is high energy intensity.

Main electrochemical processes: electrolysis and galvanic cell.

For quantitative characteristics of electrochemical processes use *the value of the current output (Co):*

$$Co = m_p / m_t$$

where $m_{product}$ and $m_{theoretical}$ is the amount of energy spent on the production of a unit of production, and the amount of energy theoretically needed to produce a unit of production; $m_{theoretical}$ is calculated by the formula according to *the Faraday law*:

$$m_t = \frac{E J \tau}{F \cdot 10^3} = \frac{K_x J \tau}{10^3} \text{ (kg)}$$

where: *F* is *the Faraday constant* (26.8 A·h);
E is the chemical equivalent of a substance;
J is the current strength, A;
τ is the electrolysis time, h;
K_x is the electrochemical coefficient, (g / A · h);
10^3 is a convert of g to kg.