CONTROL OF THE CHAOTIC OSCILLATIONS IN THE EXCITABLE MEDIUM IN ONE HETEROGENOUS CATALYTIC REACTION

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Chaotic behavior is typical for many systems with a different nature. During the definite stages of the evolution physicochemical, biological, socio-economic etc. systems are to demonstrate chaotic dynamics. Unpredictable behavior of the chaotic oscillations, ambiguity of ways of the process to end, high opportunity of realization the negative results leave us no choice but to look for the methods of controlling chaos. Lately efficient methods of control such oscillations have been developed in mathematical models assuming the chaotic oscillations. The most important of them are the methods of controlling chaos in the oscillating medium. They are: the OGY-method and its different modifications, global delayed feedback method and some other methods.

The most important reactions of the heterogenous catalysis such as the catalytic CO oxidation, the NO and CO neutralization etc. are included in many manufacturing processes. These reactions develop the chaotic behavior in definite conditions. The stable work of chemical reactors is provided with the stationary mode of manufacturing. However the nonstationary modes have been applied in chemical technologies recently. It is related to high output rate of nonstationary processes. Therefore it comes up a question of using regular and irregular oscillating modes in chemical industry.

In the present work we considered new model of reaction NO+CO/Pt(100) which describes the laboratory experiment sufficiently. It was carried out the bifurcational analysis of the point model, represented by the system of ordinary differential equations of the 2-nd degree, and the distributed model which considers diffusion of the components on the catalytic surface. It was shown that the neutralization of gases is more effective in the oscillation mode.

The area of chemical turbulence was found. System provides the spatio-temporal chaos in the excitable medium, which is characterized by the specific behavior of trajectories on the phase map where one of the main isoclinal lines is the S-shape type. Isolated running impulses arise in the excitable medium in the defined conditions. These are the localized areas of very high rate of reaction. It was shown that during changes of partial pressure of NO the isolated impulse starts oscillating. The scenario of impulse's conversion to the chaotically oscillating localized structure was studied. This structure begins replicating process and occupies all the surface of reaction. Space-time diagrams let us understand and describe the complex chaotic dynamics of the process.

In this work the fine ways of controlling chaos in the excitable medium were found. Using definite periodic changing of external parameters (temperature, partial pressure of gas) we could successfully provide the regular dynamics of the reaction. The regular behavior was represented by cascade of running impulses of high reaction's rate.