**Mechanism of direct conversion of methane into methanol and dimethyl ether with hydrogen peroxide on a biomimetic catalyst**

G.Ch.Nahmatova 1, I.T.Nagieva2, L.M.Gasanova1, T.M.Nagiev1,2

1Nagiev Institute of Catalysis and Inorganic Chemistry, 113 H.Javid Av., Baku, Azerbaijan.

2Baku State University E-mail: tnagiev@azeurotel.com



The monooxidation of methane into methanol was carried out on biomimetic heterogeneous catalyst – iron pentafluorotetraphenylporphyrin on Al2O3 (ImtOH), at atmospheric pressure and temperatures of 200-350°C, which resulted in liquid one-carbon compounds CH3OH (19.2%), CH2O (1.55%), CH3OCH3 (8.2%) with high selectivity and are widely used in the chemical industry. In order to establish the routes of these products formation and the mechanism for the methane conversion into them, the investigation of the methanol conversion reaction was carried out, as an intermediate compound of the methane oxidation, under identical conditions on the same catalyst. The result was only dimethyl ether with 100% selectivity. This proved that in this reaction system, methanol obtained from the methane monooxidation is converted only into dimethyl ether, and formaldehyde, in parallel with methanol, is formed from methane.

Our proposed catalytic system – biomimetic catalyst for the direct conversion of methane into methanol and DME, is analogue of enzymes that lead redox reactions in living systems and have a multi-functional effect, made it possible to carry out a one-stage process of methane monooxidation into its oxygenates with high selectivity.

The mechanisms of the elementary stages of the formation of methanol, formaldehyde and dimethyl ether on the surface of the bioimitator through the formation of an active complex (ImtOOH) are presented, in which the unity of the mechanisms of redox and acid-base catalysis traced within the framework of the principle of the bond redistribution chain (BRC), similar to enzymatic reactions.

Experimental investigations of the biomimetic oxidation of methanol to dimethyl ether made it possible to determine the optimal condition for the oxidation of methane to methanol and dimethyl ether in one reactor. By varying the process parameters, the reaction can be directed either towards the selective formation of methanol, or towards the selective formation of dimethyl ether.

**Biography**

Tofik Nagiev is a Vice-president of Azerbaijan National Academy of Sciences, Director of Research Center of “Azerbaijan National Encyclopedia” and Department chief of Nagiev Institute of Catalysis and inorganic chemistry of ANAS. The Professor of the department of the physical and colloid chemistry of Baku State University.

He is author of the monography “Coherent Synchronized Oxidation Reactions by Hydrogen Peroxide”, Amsterdam: “Elsevier”, p. 325, 2007.

**Presenting author details**Full name: Tofik Nagiev

Contact number: +99412 5384707

Category: Poster