

## Combined Oxidation Processes Application for Organic Synthesis

A.E. Shmidt

Scientific supervisor – PhD, Associate Professor, O.S. Kukurina

*National Research Tomsk Polytechnic University  
Russia, 634050, Tomsk, 30 Lenin Avenue, shmidt\_and\_1991@mail.ru*

The oxidative functionalization and cleavage of organic compounds represents a broad class of fundamental transformations in organic chemistry frequently employed both in academic and industrial settings for the synthesis and production of valuable intermediates and chemical commodities.

Oxidation is type of reactions that possesses several features: firstly, organic substances are capable to full and/or incomplete oxidation and products of incomplete oxidation represent an extensive class of organic compounds. Secondly, selective oxidation of organic substances allows to receive various products by means of different conditions and oxidizing reagents. Structure of oxidized products depends on the reaction mechanism and intermediates structures. Therefore study of the oxidation mechanism is a priority of our research. Moreover, reaction products can obviously indicate a certain route of oxidation [1].

The relative strengths of oxidizing reagents can be inferred from their standard-electrode potential. Atoms, ions, and molecules that have an unusually large electrons affinity tend to be oxidizing agents. An oxidizing agent is referred to a chemical compound that readily transfers oxygen atoms or a substance that gains electrons in a redox chemical reaction and the oxidizing system option has acquired significance

For oxidation of organic substances usually use compounds of transitional metals, oxygen, ozone, peroxides and compounds of sulfur, selenium, iodine, nitrogen and others. An application of a certain oxidizing agent is defined by economic reasons and reactivity of the organic substrate. Concerning the development of new technologies, a mention is deserved by the application of electrochemistry for the oxidative functionalization. At the same time processes of anode oxidation of organic substances are often very sensitive to change of anodic potential [2].

In direct electrochemical advanced oxidation processes (EAOP), the HO•, is produced and transferred directly from the electrode originated from the water oxidation in the anode, for this reason, it is frequently referred to as anodic oxidation.

In anodic oxidation, was shown that HO• are produced from the water oxidation in different anodes (Pt, PbO<sub>2</sub>, SnO<sub>2</sub>, boron doped diamond, etc) [3]. However, according to [4], the most frequently used anodes in EAOP's are

platinum and boron doped diamond (BDD).

In [5] electrochemical oxidation of toluene on glassy carbon electrodes in organic medium was investigated. Was shown, that electrochemical oxidation of toluene depends on the experimental time scale and involves different steps or reactions that could control the transformation.

Technologies of electrochemical oxidation allow to receive products with higher yield, for the majority of reactions are generally used a harmless solvents. Application of electrochemical methods for electrooxidation of organic compounds requires scrupulous study of the reaction mechanism and kinetic with identification of electrolysis products. Thus, electrooxidation is environmental friendly method and requires additional research.

### References

1. Sperry J. B., Wright D.L. The application of cathodic reductions and anodic oxidations in the synthesis of complex molecules Chem. Soc. Rev., 2006.– Vol.35.– P.605–621.
2. Steckhan E.E. Topics in current chemistry. Electrochemistry, Springer, NY, 1988.– Vol.3.
3. Gandini, D.; Mahe, E.; Michaud, P. A.; Haenni, W.; Perret, A.; Comminellis, C. Oxidation of carboxylic acids at boron-doped diamond electrodes for wastewater treatment. Journal of Applied Electrochemistry, 2000.– Vol.30.
4. Oturan M.A., Brillas E. Electrochemical Advanced Oxidation Processes (EAOPs) for Environmental Applications. Portugaliae Electrochimica Acta, 2007.– Vol.25.
5. Elia L.F.D., Ortiz R. Electrochemical oxidation of toluene on glassy carbon electrodes in organic medium. Portugaliae Electrochimica Acta., 2005.– P.481–490.

---

## Reaction range definition of vacuum distillate cracking

V.I. Stebeneva, S.V. Kiseleva, G.Y. Nazarova

Research advisor – Ph.D. in Engineering Science, professor, E.N.Ivashkina  
Linguist– English instructor, I.E.Rymanova

*National Research Tomsk Polytechnic University  
Russia, 634050, Tomsk, av. Lenina 30, tpu@tpu.ru*

Catalytic cracking (CC) process is a basis of advanced refining of oil. CC is formation of high-octane gasoline and gas for petrochemical industries, for production of carbon black and coke from heavy raw material.

CC is related to heterogeneous catalysis. Study of the thermodynamics and kinetics is the way for its optimization. This approach allows estimating the process energy, the probability of chemical transformations, defining a set of products and their maximum yield. The basic kinetic parameters of a