Description for the general public

As it was mentioned by Bond in the introduction to his monograph "in order to understand catalysis phenomenon an understanding in three classical domains of chemistry is necessary. Catalysts are the most often inorganic substances which preparation requires the knowledge about inorganic chemistry. Catalytic reactions are very often organic reactions, so familiarity with reactivity of organic particles is useful. Whereas physical chemistry methods are used to study these reactions. Finally, industrial using of catalysis requires the knowledge about a chemical engineering and deep penetration in substance properties." And despite passage of 40 years from the time of an edition this monography, catalysis is still fascinating and it remains phenomenon which is still not investigated and known up to the end because of its complexity. And there are still found its new applications in new processes and equipments. Simultaneously, a progress of new physicochemical methods of catalytic materials investigation and possibility their versatile characterization through penetration inside a catalyst structure give a chance to better understanding of catalysis phenomenon and rules of catalysts performance in given process as well as the mechanism of their deactivation. What is also important, application of characterization methods currently available allows to get an answer to the question how a catalyst which will be suitable to a given process should "looks". So not only is choice of optimum composition possible but also there is a possibility of investigation and control with different physicochemical properties of catalyst in aim of preparation of catalyst which will be active and stable and will make that the reaction will be highly selective to desired products. As there is indicated by experience and mentioned by Bond 40 years ago [1] only understanding of physicochemical properties of catalyst allows to design suitable inorganic nanomaterial which will find an application in organic reaction. Therefore, an idea of this project arose on the base of experience of scientist investigating catalysis phenomenon from the beginning of its discovery by Berlioz and on the base of possibility of modern techniques. Simultaneously, an aspect of demand of contemporary world which copes with problem of decreasing of fossil fuels and increasing of a renewable energy demand was taken into consideration. **The project concerning works on finding correlation between a size of nanoparticles of active phase of catalyst and its catalytic properties in conversion ethanol with water process**. The results of these studies could contribute to getting an answer how obtain new catalytic materials which probably can find significant application in hydrogen production - the lightest and simplest fuel that can be used for transportation, heating, and power generation in places where it is difficult to use electricity. An aim of this project seems to be very ambitious and its accomplishment would not be possible without modern and well equipped supply base for the research of catalytic properties and basic physicochemical features of obtained nanomaterials which is offered by the Department of Chemical Technology and Analytical Laboratory of University o Maria Curie-Sklodowska. It would be sin not to take proper advantage of these possibilities. What is more, both difficulties of necessity of combination of knowledge about three different domains of chemistry (inorganic, organic and physical chemistry) and hope that it would be possible to apply obtained catalysts in the fuel cell in the further future after finishing of basic research being very necessary but also very expensive, are very attractive proposal for young scientist who begins the adventure with a science.

The research will concern the catalysts with highly dispersed cobalt and nickel phase supported on high surface area oxides, namely cerium(IV) oxide (CeO_2) and manganese oxide (MnO_x) with structural promoters (aluminium, lanthanum, cerium) and small addition of specific promoters, like potassium and platinum. Standard properties of obtained nanomaterials for conversion of ethanol with water will be defined by the determination of the selectivity, activity and reducibility and oxidation studies. Also the physicochemical properties of obtained catalysts will be determined by quantitative and qualitative evaluation of volume, quantitative and qualitative evaluation of surface composition, phase analysis, evaluation of catalyst morfology, evaluation of specific surface area and porosity, evaluation of crystallite size and area, evaluation of chemisorption of hydrogen and/or carbon monoxide and its strength. All this quantities describe the distribution of different active sites on catalyst surface, the size of little nanoparticles dispersed on the support. Also measurement of structural order (lattice planes) and defects that forms around the nanoparticles and the structure of carbon deposits formed on catalyst will be done.