Recently, bimetallic catalysts have attracted significant attention in catalysis science as they have proved highly efficient as heterogeneous catalysts in many reactions. The aim of the proposal is obtaining new platinum-silver catalysts based on amorphous silica and mesoporous cellular foams MCF, NbMCF in order to obtain catalysts effective in selective and total oxidation of methanol in gas and liquid phase. Platinum and silver will be deposited on the support surface or incorporated into silica structure. Niobium will be added to the MCF structure to generate additional interactions between the support and active phases. Additionally, some computational study will be performed, to explore the interactions inside the catalyst and between catalysts and reagents of methanol oxidation.

Platinum and silver are amongst the most popular transition metals used for catalytic oxidation. In recent times, an increase of publications about bimetallic AuPt catalysts and their high activity in oxidation reactions (especially the oxidation of CO) is observed [1-5]. Silver is non-toxic, eco-friendly and cheaper than gold. In view of the fact that silver is a metal with unique oxygen catalysis capabilities, coupling Ag with Pt may lead to interesting catalytic properties. The intention of the formation of bimetallic system is to generate synergy interactions between active phases and active phases and support, affecting the form of deposited metal and consequently the catalytic activity in oxidation processes.

There is no literature data about synthesis of bimetallic Pt-Ag catalysts with using of mesoporous cellular foams MCF, NbMCF as a supports. According to our previous study [6] the bimetallic systems (Ag-Pt) will be more active in catalytic oxidation processes than the monometallic materials due to synergistic interactions between Ag and Pt. The selection of the chemical composition of the support and the amount of active phase will allow to control the selectivity of methanol oxidation process. Also it is expected that niobium could act as a promoter. Important for the project will be also understanding of changes taking place in Pt-Ag-Si and Pt-Ag-Nb-Si systems after post synthesis thermal treatment in Ar or O_2 or H_2 flow.

A significant part of the project is the characterization of obtained catalysts using standard and modern analytical techniques. The high level of advancement of selected analytical techniques ensure reliability and a very good quality of obtained results.

Expected correlations between catalytic properties and the textural/structural properties of catalysts and forms and amount of active phases will be an original contribution to the development of heterogeneous catalysis in the range of bimetallic materials. Analysis of the above relationships will lead to choosing the best procedure for the synthesis of platinum-silver catalysts that will have the desired properties. Such investigations are part of the current exploration catalysts with mesoporous structure characterized by high thermal and chemical stability and red-ox properties desired in the oxidation processes. The planned research is also useful and attractive from the point of view of ecology and economy.

Methanol vapour belongs to volatile organic compounds (VOCs) which are one of the most important component of air pollution. VOCs are major part of the photochemical smog, could negatively affect on human health and act as greenhouse gases. The way of VOCs removal is their total oxidation to carbon dioxide and water. Obtaining of catalyst which active in low-temperature total oxidation of methanol will bring a possibility of development of a new class of materials used in oxidation processes of various organic compounds.

Selective methanol oxidation is a reaction commonly used for the production of formaldehyde. Nowadays, it is performed over silver catalyst which requires a high reaction temperature and a high concentration of methanol. According to the Green Chemistry rules, desired catalysts have to be active, selective and stable even at low temperatures. Thus the challenge of the modern science is to find an efficient catalyst in low-temperature oxidation processes.

Summarizing: the proposal research fall within the current basic studies of the catalysts addressed to oxidation processes. The combination of experimental and theoretical data will contribute to a better understanding of the interactions between platinum and silver in bimetallic system and their impact on the catalytic activity in low-temperature methanol oxidation. The results should indicate the most optimal: synthesis method, chemical composition of support and the amount of active phase of catalyst efficiently in methanol oxidation.

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