DESCRIPTION FOR THE GENERAL PUBLIC

"Structure sensitivity of ammonia synthesis reaction over promoted cobalt catalysts"

Catalysis is a phenomenon in which chemical reactions are accelerated by a small amount of substances called catalysts. According to a simplified model, reagent or reagents create a complex with a catalyst, thereby opening a more efficient way of conversion to product or products. Understanding the mechanism of a catalytic reaction (i.e. its basic stages) is one of the main issues in catalysis science. In the case of heterogeneous catalysis, in which a catalyst and reactants form separate phases, another extremely important area of scientific development are studies of catalysts surface, where the most significant phenomena occur. Structure, morphology, chemical nature and an impact of promoters play a complex role in heterogeneous catalysis and may affect the reactivity of a surface.

The proposed project aims to examine structural sensitivity of ammonia synthesis reaction over catalysts based on metallic cobalt, i.e. to determine how the catalysts activity depends on the structure of the active component. Two hypotheses have been posed. They are based on the relationship of a metal crystallites size and promoters nature with a reactivity of an active phase surface. In order to verify the posed hypotheses, a series of promoted cobalt catalysts will be prepared. Catalysts will differ in a crystallites size of an active phase (cobalt) and a type of promoter. Cerium and barium will be used as promoters. Basic physicochemical properties of materials will be studied, i.e. total specific surface area and porosity, surface and structure of the active component. Conducting of characterization studies for catalysts in a reduced form, i.e. in their real state under reaction conditions, will have a crucial meaning. Knowledge about particular parameters will allow to determine the relationship between a reactivity of the catalysts surface and a structure of an active component. A size of metal particles and a presence of particular promoters can affect the surface reactivity too.

Authors of the project assume that the proposed research will allow to find a link between an action of the cobalt catalyst and its structure, morphology and an influence of promoters. As a result it will be possible to explain if and how a structure of the cobalt catalyst favourable in the specific reaction may be stabilized. Finding the answers to the above issue can help to expand the knowledge of all catalysts based on metallic cobalt. This will helpful in the design of new catalytic systems with a deeper understanding. Following this, it may be possible to search analogies to other catalysts, for which a structure sensitivity of a reaction is observed.