Although we do not realize a fact, people are common with catalysis long before chemistry recognizes the importance of the process. Nature is based on enzymes which control life and such everyday chemistry as soap production or making wine needs catalysts. Basically, a catalyst introduced into the reaction system modifies the reaction path making it easier at the same time appearing at the reaction end in the same form as at the reaction start. In other words, catalysts make available purer products which are yielded from more environmental friendly (greener) chemical processes performed at lower temperatures. Today the catalysis is a scientific research area having high impacts on a whole range of practical applications.

Current project relates to the design and investigations of new metallic nanoconjugates as potential catalysts for gas phase reduction of carbon oxides (methanation). The control of the process is among the most important needs for human civilization endangered by greenhouse effect. This is also a potential chemical energy storage system replacing still inefficient electric batteries in new environmentally-friendly hydrogen economy. Our knowledge of the system is however still below the expectations. The reaction is a multi-step complex chemical process which we need to fully understand in order to design new efficient catalysts for low-temperature heterogeneous processing.

The activity of heterogeneous catalysts is controlled by the Sabatier rule which insists that the material should be active enough to adsorb the reactant but at the same time the adsorbed reactants and products should desorb easily enough to allow for a further circulation of reactants. Therefore, some optimal adsorption energy between metal catalyst and reactants (products) exists. In our project we are planning to investigate a potential to broaden this optimal area by investigating unalloyed metallic nano-combinations. Unlike alloys which were tested as potential catalysts of various processes, unalloyed metals are uncovered area. We have developed recently an efficient method for the synthesis of such materials as well as we have shown that they are potentially interesting catalyst showing synergistic interactions. The idea of the synthesis of new catalysts includes nanoparticle synthesis, spark plasma sintering which will provide self-supporting porous structures through low energy consolidation. This will be tested as potential catalysts for methanation.

Basic research refers to investigations directed “solely toward acquiring new knowledge rather than any more practical objectives”. It does not mean however that this should not connect with the discoveries that would be applicable or demonstrate a potential of the social or economic benefits. A well known anecdote of a conversation between Queen Victoria and Micheal Faraday on electricity can be here an illustration. What use is electricity. I do not know, but someday it will be taxed. Our project is focused on new materials in particular resulted from nanotechnology. Nanomaterials are extremely sensitive toward structure differentiation, and their characteristics and applications depend not only on nano-metal type and support type but also on size, shape, and composition. We still do not understand the substantial rules for this. New knowledge is evidently needed in this area basically to satisfy our curiosity which is the source of all wisdom. On the other hand, in a formal meta-scientific structure, "nanomaterials" are similar to "electricity".