

The aim of the project is identification and analysis of dead zones inside a catalyst pellet. The problem of dead zones was reported in seventies of twentieth century, but recently, as a result of the progress in mathematical and numerical methods, they have been extensively theoretically considered. At this moment, there are no specified sufficient conditions for dead zone formation. It is difficult to predict based on a model how to carry out a catalytic process. If to be sure that dead zone will be formed then e.g. one could use catalysts of the core-shell analogous to that type of sorbents used in chromatography or try other ways to improve efficiency. Finally, there are no comprehensive analysis of the influence of a dead zone on efficiency of the process (it is worth noted, that usually negative influence of dead zone on efficiency should be expected, but in specific cases also positive influence can be expected). The mentioned gaps should be at least partially filled in this project. The project will be realized theoretically while experimental investigations will be employed for verifying and modifying relationships and procedures developed. Theoretical considerations concerning origination of dead zone in a catalyst pellet are expected, namely the conditions for origination of dead zone will be determined and the influence of dead zone on efficiency of the catalytic process will be evaluated. Experimental investigations will be carried out in accordance with the principles of chemical reactors engineering. In the first stage a kinetic equation of the tested process will be determined. In the next stage consist experimental verification of theoretically developed relationships and procedures. It will be carried out in fixed-bed reactor.

The character of the project is fundamental. The tasks included in this project can enrich and deepen our knowledge on heterogeneous catalysis processes (also in practice). Due to important problems both for theoretical consideration (inconvenient analysis of non-linear boundary value problem) and for experimental investigations (there is no direct method of dead zone detection, indirect methods need high precision of measurements process variables and parameters and inconvenient analysis of the results) problem of dead zone origination has not yet been developed suitably to the its importance. Realization of the project aims fills the gaps in human's knowledge and as a result understanding of great importance process will be improved. Procedure for dealing with the formation of dead zone will be elaborated for catalyst designing and manufacturing. It should make heterogeneous processes more effective and to reduce costs.

It should be noted that the confirmation of the concept of "dead zone" for catalytic processes will mean that investigations should be extended to other gas- and liquid-solid processes, for which there are periodic shortages of the active substance inside the pores - e.g. in the widely used in the practice of chromatographic processes, for different types of biochemical processes, for processes running in accumulators electrodes and for power engineering - technologies of storing oxidizing of hydrogen on porous structures (in not far future).