

DESCRIPTION FOR THE GENERAL PUBLIC

The main task of proposed project is to perform numerical and experimental studies concerning formation and deposition of carbon solid particles from the gaseous fuels on porous materials in the laminar flow. It is a serious problem for many power engineering and chemical units, especially in systems based on solid oxide fuel cells fueled by gases based on carbon and hydrogen elements. For that reason, studies performed for the proposed project will concern this type of systems.

Fuel cells are among the group of devices, which through and electrochemical process convert chemical energy of the fuel directly into electricity. SOFC fuel cells are characterized by high operating temperature (600-900°C), long and stable operation, high efficiency (45-65%) and low generation of emissions. The main elements of SOFCs are cathode, electrolyte and anode. In addition, SOFC can be fueled by different type of gases, from pure hydrogen through mixture of hydrocarbons, carbon monoxide, biogas and others. Fuel is applied on the porous material of the fuel cell, i.e. anode. In case of SOFC fueled by these gases, the coal deposition process occurs in this part of the fuel cell.

Based on the current literature, it can be stated that the researches concerning speed and rate of carbon deposition on porous surfaces were performed by controlling the operating temperature of the unit, composition/type of fuel and ratio of amount of steam to amount of atomic coal in the fuel (S/C). Additionally, the studied aspect was also the material type from which the rinsed porous surface was made of. In the current literature there is no information concerning the influence of the gas velocity and degree of flow turbulence on the formation and carbon deposition process. This is an important subject, which researching will allow to even better understanding of described process.

The proposed project assumes performance of series of experiments, which will determine the effect of gas velocity and degree of flow turbulence on carbon deposition. Research will be conducted for different fuels, temperature, S/C ratio and in case of solid oxide fuel cells – current load. In addition, the mathematical model will be created, describing the mechanisms behind this carbon deposition process on the porous surfaces of SOFC and other chemical and power engineering units. The results from experiments will be used as a validation data for the designed numerical model, thus it will be possible to determine general description of the carbon deposition process for different flow parameters. Generated results might be used in the future as a key data in order to study the ways to minimize and eliminate carbon deposition process.