The aim of the project is to find and investigate new catalytic materials for anodes for Solid Oxide Fuel Cells (SOFCs) in order to ensure efficient and long-term operation of these cells when running on biogas. This fuel, sometimes called a landfill gas, occurs as a natural product of fermentation of organic compounds, e.g. in big or agricultural waste landfills. Solid Oxide Fuel Cells could provide a stationary power source at landfills, farms etc., but at the moment, the investment cost associated with the installation of the system and the problem of degradation of the cells under the influence of carbon deposition and sulfur poisoning restrict the application of SOFCs operating with biogas on a large scale.

Therefore, it is necessary to carry out systematic research in order to find the optimum catalytic material, which limits carbon deposition and sulfur poisoning problems during the internal reforming of biogas taking place directly in the cell. The influence of the type and quantity of dopant introduced into a starting ceria catalytic material will be specified. This material will be applied in a fuel cell using two methods: as an additional layer deposited on the surface of Ni-YSZ anode and also as an independent anode (alternative to Ni-YSZ cermet). Basic research of structural properties will be carried out using various experimental methods, e.g. X-ray diffraction, scanning electron microscopy and energy dispersive X-ray microanalysis. The amount and nature of deposited carbon will be analyzed using thermogravimetry and photoelectron spectroscopy method. Investigations of electrical properties will be carried out using DC and AC-methods. The parameters of operating fuel cell cells (current density, OCV, I-V curves) will be analyzed within a period of at least 100 hours. In addition, using FTIR spectrometer, there will be conducted an analysis of composition of gases before and after the biogas reforming process. These results, combined with the theoretical simulation of electrochemical reactions occurring in the cell, will allow understanding and describing the processes of carbon deposition of sulfur poisoning at the anode.

Examination and description of the issues established in the project will have an important contribution into current knowledge about mechanisms of carbon deposition and sulfur poisoning in SOFCs. This project will help to determine the optimum operating conditions of the cell and will indicate directions for future research and implementation work. To date, a number of considerations on biogas use in the cells are merely the simulation. There is a lack of basic materials research, so this project will complement the existing state of art of SOFCs operating with biogas and perhaps will help you find an alternative, better than the commercially used anode materials for these cells.