The project is proposed because current forecasts concerning nonrenewable fuels and pro ecological policy introduced in many countries forces to produce a growing part of the consumed energy in the country in a clean way, reducing CO_2 emissions. High temperature fuel cells are the most efficient devices for chemical (fuel) energy conversion available today. As a side product water and heat are created which can be additionally used in co-generation systems. Power obtained from single cell is relatively small thus they are connected to form stacks what allows to deliver high power. To connect cells into a stack interconnectors are needed. It is well known that during the construction of every system low cost is one of the crucial parameters. Replacement of traditional ceramic interconnectors with steel ones allows for large cost reduction. However in cell working conditions low electrical conductivity of corrosion products formed on the steel surface, decrease power obtained from the stack. Additionally chromium poisoning of the cathode shortens cell lifetime. The research problem related with protective layers for stainless steel is proposed in order to: decrease oxide scale growth rate, examination of the required amount of ceria dopants to the manganese cobalt spinel to find the layer that gives most efficient protective properties. Additionally, project will test novel double layer cerium oxide - manganese cobalt spinel system and a spinel modified by ceria addition. It is expected, that introduction of cerium oxide layer will decrease creation of chromia/ manganese chromium oxide which has two orders lower conductivity than manganese cobalt spinel layer. If protective layers with high protection abilities will be applied, it will be possible to create solid oxide fuel cell stacks with higher power and longer lifetime.

To realize the project, liquid precursor solutions will be prepared from appropriate nitrates salts and ethylene glycol. Ethylene glycol will serve as a liquid carrier of cations in the solution and will allow to deposit dense continuous layers at temperatures below 400 °C. The simplicity of precursor preparation provide a flexible control of the complex stoichiometry of the deposited layers. This helps with preparation of the manganese cobalt spinel layers with different ceria dopant content. Prepared solutions will be used for optimization of the deposition process, which can be slightly different for different compounds. Hot plate temperature and flow rate will be adjusted as needed. Distance between the hot plate and the spray gun nozzle and spraying pressure will remain fixed. Deposited layers will be examined structurally and microstructurally by using scanning electron microscopy, x-ray diffractometry etc., in order to check quality, density and tightness of the layers. After examination of the as-deposited layers they will be oxidized at 800 °C. Sets with different layers will be oxidized in different time range till 1000 h. After oxidation structural and microstructural examinations will be repeated. Thermogravimetric measurements will allow to compare corrosion rate for the uncoated steel, steel covered with manganese cobalt spinel, steel covered with manganese cobalt spinel modified with cerium oxide addition to 20 mol% and steel covered by a double layer ceria oxide - manganese cobalt spinel coating. Electrical examination will help in evaluation, which kind of corrosion protective layer allow to achieve the highest power from the cell stack. On the steel without protective layer and on with three described kinds of protective layers LSCF cathode material will be deposited in order to check rate of cathode chromium poisoning for each kind of examined samples in cathode working conditions.