Due to higher and higher consumption of energy carriers such as crude oil or earth gas, it is justified to look for alternative sources of obtaining energy resources of such type.. Many of gaseous and liquid fuels are synthesized on nickel-based catalysts.

Currently, the highest efficiency of the hydrogenation synthesis is obtained for nickel third generation catalysts doped with precious metals. The presence of Pt, Ru and Rh, which improves the level of their reducibility and resistance against deactivation, locally increases concentration of hydrogen which takes part in the synthesis. It is claimed that the improvement of catalytic properties of modified materials results from creation of alloys in the process of catalyst sintering and its activation during reduction with gaseous hydrogen.

Moreover, nickel alloys are used in fuel cells and electrolytic cells for industrial production of hydrogen and oxygen. Literature indicates that the addition of Co, W, Mo and platinoids into nickel electrodes can decrease the overpotential of hydrogen evolution process and also increase corrosion resistance in sodium hydroxide solutions which is widely used in industrial process.
On the basis of the electrochemical method alloy coatings of a wide range of chemical composition can be obtained. Moreover, there are no limits on the size or irregularity of the obtained structures surface which is a very important issue for materials of catalytic properties.

The main aim of the research is to determine the parameters range of electrolysis to obtain alloy materials of Co-Ru and Ni-Ru. Additionally, the application of polystyrene matrixes, spread on the substrate surface before the electrodeposition process, will allow a significant development of the catalyst active surface. The synthesis of coatings will be performed through electrolysis of solutions containing nickel introduced to the system in the form of $NiCl_2$ and chloride salts of Ru, Rh.

The first stage of the tests will be to determine a range of potentials in which co-deposition of alloy coatings is observed. It will be realised by classical voltammetric tests with a gold disk electrode and a quartz microbalance. It will enable to define the range of activation and diffusion control of the deposition process that strongly determines the quality of obtained coatings and the state of inner stresses. Then, the influence of the solution composition change will be examined, i.e. electrolysis potential, concentrations of individual metals in the electrolyte, solution pH, addition of complexing agents, surface active agents on the process of deposition and final composition of the alloy. The last changeable parameter whose influence will be tested is application of a homogenous magnetic field of different density and field orientation. It is believed that the magnetohydrodynamic effect induced by the magnetic field will significantly streamline transportation of ions of ferromagnetic metals to the electrode surface, which in turn will improve the alloy quality.

After receiving detailed information on the synthesis of such material of strictly defined composition, there will be attempts undertaken to obtain 3D structures of strongly developed surface. Polystyrene spheres of nanometric sizes spread on the working electrode surface will be applied to do so. During the electrolysis the alloy will crystallize in spaces around matrixes, creating compact, ordered structure of a honeycomb. After obtaining such a material, polystyrene will get dissolved revealing a developed structure of the alloy. The performed tests will alloy to deepen the current state of knowledge on electrodeposition of Ni-Ru and Ni-Rh alloys, the influence of electrolysis parameters of the structure, and morphology of the obtained alloys.

An innovative approach is the use of a magnetic field to modify the crystalline structure of coatings, which, especially for ferromagnetic elements, can improve their catalytic properties. Another important thing is resignation from the conventional method of catalysts synthesis of that type and application of the electrochemical process to obtain alloys of strongly developed surface with the use of nanometric matrixes.