Metallic materials are now the most widely used group of materials in almost every area of our lives. Compared to ceramic and polymer materials, the aforementioned metallic materials are characterized by very good electrical and thermal conductivity, as well as very good mechanical properties, such as high strength and hardness. Materials of this type are widely used under high temperature conditions, like e.g. in turbojets or stationary gas turbines. Nowadays, strong emphasis is placed on reducing greenhouse gas emissions to the atmosphere. Hence, there is a strong shift away from fossil fuels towards alternative fuels such as hydrogen enriched fuels. Combustion of hydrogen, in addition to reducing greenhouse gas emissions to the atmosphere, has, however, certain consequences. First, the combustion of hydrogen increases the exhaust gas temperature, and thus the working temperature of the materials used in the hot turbine parts. Second, the combustion of hydrogen increases the water vapor content of the exhaust gas. Increased combustion temperature practically eliminates Ni-base superalloys from their application, because at present, the temperature of their operation has reached the maximum temperature limit of their application. Therefore, materials are sought that can potentially replace the Ni-base superalloys and, what is more important, meet new requirements.

It has been reported that the presence of water vapor in the atmosphere during high temperature exposure of Ni-base superalloys negatively affects their corrosion resistance. Additionally, oxide scale formation results in a depletion of the material in the near-surface zone, which in turn causes changes in the microstructure of the materials in these areas. Strength properties strongly depend on the microstructure of metallic materials, therefore a change in the microstructure of alloys changes their mechanical properties. For this reason, a material that exhibits high microstructural stability at high temperature is desired. High entropy alloys (HEA's) are the most promising group of materials showing high microstructure stability at high temperature. Despite the fact that the resistance to high-temperature corrosion of high-entropy alloys in dry atmospheres (without water vapor) has been investigated, no single information is available on the resistance to high-temperature corrosion of HEA’s in an atmosphere containing water vapor.

Therefore, the aim of this project is to produce high-entropy alloys with excellent resistance to high-temperature corrosion in an atmosphere containing water vapor. For this purpose, the conditions of the heat treatment process will be optimized, which will result in different microstructure of HEA's alloys. As a result, the influence of the microstructure of HEA's alloys on their resistance to high-temperature corrosion in wet gases will be clearly described. Additionally, a mathematical model will be created that will allow to predict the resistance to high-temperature corrosion of HEA's alloys under oxidation conditions in gases containing water vapor.

The proposed design is pioneering in this field as, **for the first time, high entropy rates (HEA's) will be studied in an atmosphere containing water vapor**. Additionally, the influence of the microstructure of HEA's alloys on their corrosion resistance in wet and dry atmospheres will be determined. The obtained results will provide completely new information on the behavior of HEA's alloys in atmospheres containing water vapor at high temperature depending on their microstructure. A different microstructure, on the other hand, will be obtained by modifying the parameters of the heat treatment process. Results obtained in the frame of proposed project will significantly increase our understanding of HEA's behavior at high temperature in a humid atmosphere. The created mathematical model will be a useful tool for predicting the properties of HEA's alloys under high temperature oxidation in atmospheres containing water vapor.