

## Popular science abstract of the project

The pyrolysis process has been known for thousands of years, for hundreds of years it has been used to obtain chemical products and charcoal. This process is still used today in many branches of technology and chemistry. However, the mechanism of thermal decomposition of a single particle is not yet well understood. Pyrolysis is the process of thermal decomposition taking place without oxygen access. The pyrolysed wood decomposes to a series of products in three states of aggregation. The combustible gas which is released during the pyrolysis is a mixture of carbon dioxide, carbon oxide, hydrogen, methane, and, to a lesser extent, other gases. Also, the liquid fraction is created which consists of pyrogenetic water and a series of organic compounds (aldehydes, aliphatic hydrocarbons, aromatic compounds, etc.). Another result of pyrolysis is the solid fraction – biochar, being carbon concentrate. This phase contains also mineral particles coming from the fuel. The research planned within the framework of the project is expected to deliver the information about the course of single particle pyrolysis. Determining the rate of pyrolysis and its products will help to understand the process better. Since the pyrolysis is a stage of gasification and combustion processes, the obtained results will be helpful in better understanding of these processes as well. The research will be performed in an especially designed and constructed high-temperature furnace, the structure of which will allow the user to apply radiographic methods and tomography. For the time being, the proposed methodology has not been used in this type of research, which makes the project highly innovative in nature. The application of new measuring techniques provides opportunities for recording new and original results concerning pyrolysis and gasification processes, which have been beyond the scope of recognition for conventional research methods burdened with certain limitations (invasiveness, lack of on-line analysis of the pyrolysis). The research will be performed using two analytic techniques, which are radiography and tomography. Radiography is the method which makes use of the radiation emitted by an X-ray tube or radioactive isotope. The radiation source is placed on one side of the examined sample and the radiographic film on the other side. The wood sample is pyrolysed and a series of photos are recorded during the pyrolysis process. We can observe in the radiographic images how the density of the sample changes in its particular areas. These changes testify to the gasification of volatile matter. Indirectly, they can also indicate the rate of heating of particular sample parts, as for given material the temperature of pyrolysis is known. The other method of analysis is tomography, it is a non-destructive technique that provides three-dimensional images of the objects internal structure. This technique is a development of radiographic methods, consisting of taking a series of photos of samples at different angles. This research will contribute to better recognising of pyrolysis and gasification processes. It will also deliver the input data for numerical modelling of the process.