316L stainless steel belongs to the group of special steels that, due to their excellent corrosion resistance, are widely applied in e.g. a petrochemical industry or a medicine. An application of conventional fabrication techniques that involve equilibrium conditions, results with a 316L steel with an austenitic single phase structure. However, this material is hardly processed, what implies a necessity of using multi-step fabrication techniques. An utilization of laser assisted additive manufacturing methods is an alternative attempt to a fabrication of fully functional components made of 316L steel in a one or maximum two (including a finishing treatment) processing steps. What is worth noted, according to reported data and results of a preliminary research 316L steel components manufactured by laser assisted methods are characterized by an unusual dual-phase austenitic/ferritic structure and new mechanical properties. The main scientific aim of the project is an analysis and description of the mechanism of austenite destabilization and the local phase transformation in bulk and thin-walled elements made of the 316L stainless steel by using controlled parameters of a laser additive manufacturing process Laser Engineered Net Shaping (LENS). The impact of a structural transformation in 316L steel from a single- to austenitic/ferritic dual-phase structure on selected mechanical properties and a corrosion resistance of obtained samples, will be also analyzed. The high values of cooling rates are specific for a laser assisted melting of powder materials leading to non-equilibrium thermodynamic conditions. Hence, the conventional description of mechanisms and phenomena taking place during the laser deposition/building of the materials cannot be directly used to describe a mechanism of the dual-phase formation.

An innovative nature of planned research will allow a full characterization of an initial powder batch, as well as final components made of 316L steel; and a determination of basic process parameters/structure/mechanical properties relationships. Obtained results of structural evaluations and temperature profiles recorded upon the deposition step will allow describe phenomena and crystallization mechanism that take place during a laser assisted melting of the material.

A completion of the planned research and a validation of the hypothesis will be carried out by using laser assisted additive manufacturing LENS method. The LENS method is a intensively developed, computer aided technique of a fabrication of bulk components from metallic, ceramic or composite powders. In this method a powder is directly supplied into a laser beam area, where is heated up, melted and then layer-by-layer crystallized on a substrate. A component shape is directly taken from *a priori* prepared three dimensional CAD model. A high purity, chemically homogeneous and a good metallurgical quality (e.g. lack of a porosity), alloyed metal powders with a spherical shape and a granulation 44÷150 μm are usually used as an initial batch in the LENS technology. The application of high quality powders ensure obtaining good quality final products. This technology allows simultaneous forming of a microstructure and geometry of the manufactured component through a precise control of working parameters such as: the powder flow rate, the laser power, the feed of the working table or the heat transfer rate. The proper selection of process parameters has a crucial impact on temperature gradient and a cooling rate which, in turn, determines a microstructure of processed samples.