The objective of the project is to investigate the mechanism of the tribofilm producing on the nickel-based sintered materials with the addition of lubricants. One of them is calcium fluoride – CaF_2, which is the high temperature solid lubricant. It means that the CaF_2 has the best tribological properties at elevated temperature. Because of this feature, calcium fluoride can be used in nickel–based sintered materials. These materials have many interesting properties such as high temperature resistance, i.e. very good oxidation resistance at elevated temperature. They will be produced by the powder metallurgy.

During the first stage of work, the appropriate powders will be prepared in order to fabricate the sintered materials. Next, the powders will be mixed for uniform distribution of calcium fluoride particles in the volume of the composite. The mixed powders will be pressed, and then, the moldings will be sintered at an appropriate temperature. After this process, the microstructure, hardness and wear resistance will be investigated in order to reveal, study and evaluate the mechanism of tribofilm producing. The microstructure evolution will be investigated before and after sintering using metallographic specimens. Optical microscope (OM), scanning electron microscope (SEM) in Backscattered electrons (BSE) and secondary electrons (SE) contrast will be used for the microstructure analysis. The topography of samples will be revealed using SE contrast, and thus, SE images will be characterized by depth in field. However, the BSE contrast will be also used in order to reveal the difference in chemical composition of the samples. It will allow to distinguish the elements of high density (heavier) from the light elements (of low density). This property is very important for the mechanism of the tribofilm producing on the surface of sample, because calcium fluoride has lower density compared to another elements of the sample. Next, the microstructure evolution will be investigated by laser scanning confocal microscope using the fluorescence phenomenon in order to reveal the tribofilm. Calcium fluoride has fluorescence properties under agitation with light of a specific wavelength. So, it will be light on the samples' surface. Next, the microhardness tests will be performed. The Vickers method will be used for determination of the influence of the addition of calcium fluoride on the mechanical properties of the sintered materials. The tribological tests (using "ball–on–disc" method) will be carried out in order to produce the tribofilm on the samples and to investigate the mechanism of tribofilm formation. These tests will be provided in different conditions, such as applied load and the temperature, which will be changed from room to the elevated temperature (up to 600°C). An important issue is to study the influence of temperature on the mechanism of tribofilm producing.

Nickel-based alloys are modern materials, which are often used nowadays, because of the unique properties. The knowledge regarding the mechanism of the tribofilm formation at room and at elevated temperatures will provide a large development of materials science, because this mechanism isn't well-known.