

The scientific aim of the project is to develop a method for assessing the stability of the microstructure of vegetable lubricants and explain at the molecular level the mechanism of destabilization their microstructure caused by friction, using spectroscopic techniques of DWS diffusing microrheology and Raman spectrometry.

The diffusion spectroscopy - diffusing wave spectroscopy (DWS) and Raman spectroscopy will be used to analyze changes in the chemical structure of lubricants. It was adopted, that is possible to assess the stability of the microstructure of vegetable lubricants in the friction process, which are non-Newtonian liquids, by determining the rheological parameters and kinetics of changes in the lubricant microstructure by correlating the rheological characteristics obtained by DWS diffusing spectroscopy with changes in the chemical microstructure determined by Raman spectroscopy.

The experimental work undertaken in this application aim to: explanation of changes in the microstructure of the evaluated lubricants on the base of the analysis of the MSD correlation function determined using diffusion spectroscopy and spectra determined by Raman spectroscopy, resulting from their different structure, determination of tribological characteristics, including the coefficient of friction and rheological under variable test conditions (tribosystem loads, spindle rotational speed, temperature) of the tested lubricants using a rheometer with a tribological cell, determination of Stribeck curves, rheological characteristics and calculation of the Stribeck parameter under variable test conditions (tribosystem loads, temperature) of the tested lubricants using a rheometer with a tribological cell, investigation of the influence of temperature changes, tribosystem loads and spindle rotational speed using the DWS diffusion spectroscopy technique during tests carried out by means of a rheometer with a tribological cell on the changes of the correlation function MSD and the index of elasticity of lubricants, investigation of the influence of temperature changes, tribosystem loads and spindle rotational speed using the Raman spectroscopy during the tests carried out using the rheometer with a tribological cell on the change of integration intensity of characteristic lubricant bands, analysis and evaluation of changes in the chemical structure lubricants subjected to extortions carried out by a rheometer with a tribological cell in friction tests, under the conditions of the influence of variable loads of the tribosystem, spindle rotational speed and temperature using the diffusion spectroscopy DWS and Raman spectroscopy.

The aspects concerning the analysis of the surface and interfaces of the surface layer have long been the subject of the research work on pure chemicals with a defined composition or model chemical compounds, however, the characterization of changes resulting from the interaction between the lubricant and tribosystem elements, despite the work of many scientists for years, has not been sufficiently well understood. Characterization of changes at the microscopic level of the microstructure of the tested lubricants by diffusion spectroscopy and correlation of the obtained results by Raman spectrometry is an innovative approach to evaluate the quality of lubricants subjected to forces in friction process.

As a result of the project, a new method will be developed for characterizing changes in the microstructure of vegetable lubricants at the molecular level. It will be the basis for the development of technological solutions in the field of environmentally friendly lubricants with the assumed properties. It will make it possible to eliminate costly tribological tests with the use of friction kinematic systems.