Introduction. Emission of airborne particulate matter has been one of the essential research subjects due to the environmental and health concerns. Submicron particles penetrate the human body through breathing, drinking, eating and skin contact and reach its internal organs. Correlations were found between high concentrations of airborne particulate matter and increased morbidity due to various diseases. People living in urban environments are subject to higher health risks due to airborne particles emitted from different anthropogenic sources including transport vehicles. Cars, buses, trucks, trains and other transport vehicles are equipped with brakes in which the braking torque is provided by the friction between pads and discs. During braking, wear particles are generated at the sliding contacts, and some of them are then emitted to the atmosphere. Thus, the problem of emission of airborne particles from sliding contacts is one of the fundamental problems at the intersection of Tribology, Aerosol Science and Ecological Science.

Research project objective and concept. The overall purpose of the present project is to *develop a new method for evaluating emissions of airborne wear particles from sliding contacts with account of contact temperature*. The concept of the project is based on employing an original aerodynamic chamber for airborne wear particle measurements, original acicular thermocouple technique for contact temperature measurements and energy hypothesis for airborne wear particle emission. The *aerodynamic chamber* will be designed and optimised to provide maximally linear, laminar and uniform airflow from the sliding contact region to the outlet, which enables high-efficiency sampling of 6 nm to 10 μm airborne wear particles and accurate determination of the particle emission rate. Accurate and reliable measurements of temperature at the sliding contact will be done by *acicular thermocouples* based on an original wire-in-hollow-cylinder construction. The known hypotheses for airborne wear particle emission will be experimentally validated, with special focus on the *energy hypothesis* that takes account of the friction force.

Research project methodology. Successful implementation of the project requires solution of the following research tasks using scientifically justified approaches and methods. (1) Design of the aerodynamic chamber for airborne wear particle measurements by optimising airflow streamlines with the aid of numerical simulations. (2) Validation of the aerodynamic chamber for airborne wear particle measurements by its installation inside a tribometer and incorporation into an aerosol measurement system with cascade impactor and scanning mobility particle sizer. (3) Conduction of the experimental studies of the friction materials in terms of the tribological characteristics (friction coefficient, wear mechanism, mass wear rate, contact temperature, surface roughness), mechanical characteristics (hardness, elastic modulus, strength limit), thermal characteristics (specific heat capacity, thermal conductivity), chemical characteristics (elemental composition), airborne wear particle characteristics (emission rate, size distribution, shape, morphology, porosity, density, elemental composition) for a wide class of friction materials, including steel, cast iron, metallic materials, polymeric materials, ceramic materials, multi-ingredient materials and modified surface materials, and various stationary and transient friction conditions. (4) Determination of the experimental dependencies between the mentioned characteristics and friction conditions using the statistical methods and validation of the known hypotheses for airborne wear particle emission. (5) Transfer of the project results from the laboratory to full-scale friction systems based on the analysis of the scientific literature, technical reports and experimental data provided by the foreign and domestic partner institutions.

Expected impacts. The project results will lead to the new method that enables accurate quantification of 6 nm to 10 μm airborne wear particles for the wide class of friction materials and various friction conditions. The project outcomes are expected to have many *scientific impacts*: development of the high-efficiency aerodynamic chamber for airborne wear particle measurements, approaching the solution of the problem of identifying wear mechanisms at sliding contacts based on the analysis of airborne wear particles, approaching the solution of the problem of finding the proportion between the emitted airborne wear particulate matter and total wear, identification of the relationship between the particle emission rate and temperature at the sliding contact, estimation of the application ranges of the known hypotheses for airborne wear particle emission, formulation of a new hypothesis for airborne wear particle emission, etc. In addition, one can expect *ecological impacts*, such as approaching the solution of the problem of predicting the ecological damage caused by transport vehicles, approaching the solution of the problem of designing eco-friendly friction systems, more accurate evaluation of toxicity of airborne wear particles, contribution to the legislation related to the restrictions on particulate matter emissions from transport vehicles; *economic impacts*, such as development and introduction to the market of eco-friendly friction systems like brakes, clutches, sliding bearings, sliding guideways, electrical sliding contacts; *social impacts*, such as increase in awareness among people about eco-friendliness of machines with friction systems.