

VORTEX PROCESSES AND TECHNOLOGIES

Founded in 1993.

Head of the research group: **Nikolay Efimovich KURNOSOV**, Doctor of Engineering Sciences, Professor, Honoured Worker of Higher Education.

Members of the research group: K. V. Lebedinskiy, PhD in Engineering; A. V. Tarnopolskiy, PhD in Engineering, Associate Professor; A. A. Nikolotov, Senior Engineer; D. P. Alekseev, Senior Engineer; A. A. Zemtsov, Senior Engineer.

Research activities are focused on the development of the theory of hydro-, aerodynamic, and thermal energy processes of heat and mass transfer in multiphase gas-liquid media with swirling (vortex) flow, as well as on the fundamentals and development of new types of energy-saving technologies and devices.

The research group's main research areas are as follows:

1. Development of physical and mathematical models for energy and mass transfer processes in vortex flows of gas, liquid, and heterogeneous liquid-gas vortex flows.
2. Development of methods for intensifying technological processes through the use of heat and mass transfer processes in swirling liquid-gas flows.
3. Practical applications of effects and phenomena occurring in swirling flows of gas, liquid, and heterogeneous media for creating new technologies and devices.

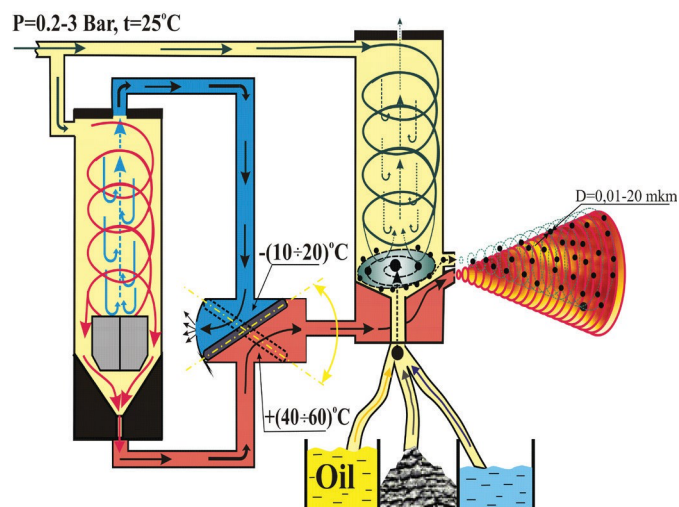
The research outcomes include the development of a range of multifunctional devices designed for various applications, operating on the principles of utilising swirling flows, such as:

- Contactless heating of technological liquids;
- Ultrafine dispersion spraying of liquid, viscous, and powder-like materials;
- Cooling and heating of gas media through high-velocity swirling flow;
- Gas and liquid ionisation;
- Hydrodynamic cavitation;
- Product cleaning;
- Liquid aeration;
- Liquid and gas purification;
- Biomedical technologies for traumatology and therapy, room disinfection;
- Climate engineering;
- Deep processing of petroleum products;
- Technological support for mechanical engineering production.

All projects are protected by patents of the Russian Federation.



■ A prototype device for fine dispersion spraying with simultaneous heating or cooling of the sprayed substances (developed under a state contract with the Ministry of Defence of the Russian Federation)





■ Production models of cooling systems for cutting tools operating during machining

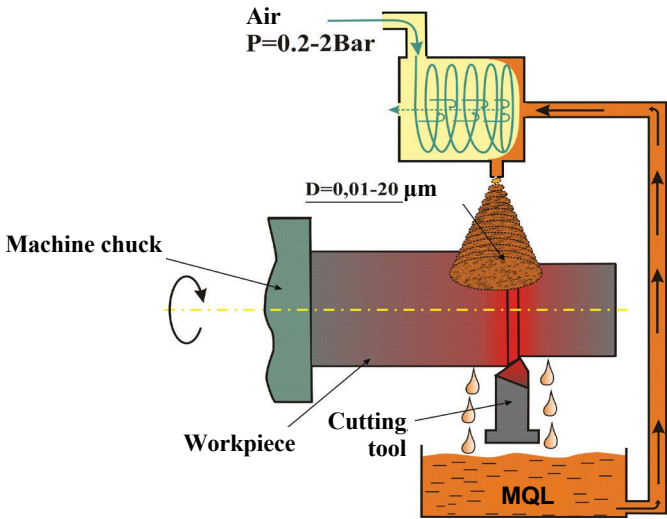
The research group has participated in more than 15 R&D projects commissioned by the Ministry of Defence and the Ministry of Industry and Trade of the Russian Federation as well as in grants funded by the Foundation for Assistance to Small Innovative Enterprises in Science and Technology, among others.

The research group is a resident at the *Skolkovo* Innovation Centre.

The group’s projects have received 32 medals at various international exhibitions.

The research outcomes have resulted in the publication of over 300 research papers, including 16 methodological manuals and 2 monographs. The group has received around 70 inventor’s certificates and patents, including international ones, and has achieved over 120 implementations.

The research group’s members have defended a Doctor of Science dissertation and 2 PhD dissertations and have supervised 8 PhD students.



■ An industrial prototype of a tracheobronchial nebuliser with a breathing tube and a child’s mask (developed under a state contract with the Ministry of Industry and Trade of the Russian Federation)