The quality of the air we breathe determines our health and also the comfort of everyday life. That's why new and more efficient materials that would improve the air quality are still sought after. One of the already used solutions is the application of the photocatalysts based mainly on titanium oxides. Despite many advantages, this material has some limitations but also scientifically justified potential for its modification. It would be expected the increase in its activity and possibility of removing, in a simple way, different types of air pollutants: volatile organic compounds (VOCs), heavy organic compounds forming suspensions (e.g. PAH), suspended particulates including inorganic substances and suspended microorganisms such as bacteria, viruses, fungal spores etc. The presented project aims to develop a completely new hybrid material with a set of unique properties that forms the coating on fibrous structures providing significant improve photocatalytic processes and the accompanying phenomena favouring the degradation of various types of air pollutants.

Preliminary results of research and analysis of the subject literature allowed us to make the following hypothesis: the raw and structural designed fibrous material, modified with a hybrid coating, containing nanowires (nanofibers) metallic coated and/or doped with a highly active photocatalyst such as tin oxides (Sn_3O_4) will be able to meet the expectations specified below:

- The fibrous material will create an active, spatially developed structure supporting for hybrid coatings. The fibrous structure will ensure large contact area of the purified air with the catalytically active surface of the hybrid coating.
- Metallic nanowires, forming with tin oxides, the hybrid conductive material will perform the following roles:
  - will provide electrical conductivity, which ensures to give the electric potential of the surface enabling attraction of the suspended particles including inorganic, aerosols and microorganisms,
  - the phenomenon of plasmon resonance occurring in nanoparticles and nanowires will increase the photocatalyst efficiency even under visible light illumination,
  - will bind tin oxide particles providing mechanical stability and good adhesion to the surface of fibrous structures,
  - the silver and copper contained in the nanowires will work bactericidal and fungicidal, supporting photocatalytic processes, which produce active oxygen and free radicals, in the destruction of microorganisms,
  - a hybrid coating containing metallic nanowires and tin oxides will protect the underlying fibrous material from exposure to UV radiation thus preventing its degradation.
- Photocatalytic tin oxides pure and/or doped will have catalytic activity that exceeds titanium oxide (anatase) and will be in the form of a hybrid coating with metal nanowires responsible for the decomposition of organic substances and the biological activity.

It is also planned to research the increasing the photocatalytic and biological activity of fibrous structures with a ceramic-metallic hybrid coating by using additives based on the graphene. The hypothesis that the placement of the produced material in the electric field with the high intensity of will allow to extend the lifetime of the excited hole-electron systems, and thus increase the photocatalyst activity, will also be checked.

Laboratories of the University of Lodz and departments and accredited laboratories of the Textile Research Institute are equipped with special apparatus that allows testing many features of nanomaterials and fibrous structures, related to their physical and chemical structure, electrical conductivity, mechanical properties, interaction with light and many other key parameters. However, even the most sophisticated research systems and the best-equipped laboratories become truly productive only if they are involved in committed researchers with extensive experience. Our research teams have already realised many national and international research programs, working on the preparation, characterisation and implementation of nanomaterials and the functionalization of fibrous materials.

The effect of these works is tens of publications, patent applications and patents received, as well as participation in numerous national and international conferences. The project research will allow learning the factors correlating the method of production, structure and physicochemical properties with the expected features of multifunctional modified fibrous structures. Researchers involved in the project are convinced that in addition to publications in scientific journals, the obtained research results would find application in many areas of life from health care, through improving the comfort of life, to applications related to security and defence.