CORONA RESEARCH AT FRAUNHOFER IKTS

Ceramic solutions to combat the Coronavirus pandemic

The challenges we are facing have shown that research and innovation are key to stemming the tide of the Coronavirus pandemic and its consequences. We are therefore working on several projects in which we use the outstanding range of properties provided by high-performance ceramics in the area of biomedical analytics and protection against infection.

MEMBsS

Decentralized supply of oxygen for ventilators

With the aim of increasing the number of available ventilators for severely impacted COVID-19 patients in times of peak demand, we are working to develop oxygen generators that allow to produce pure oxygen in a decentralized structure, to be set up in varying locations as needed in hospitals or provisional care facilities. The systems separate oxygen from ambient air. This oxygen is sterile and free from virucidal components. The separation process is based on mixed-conducting ceramic membranes which at high temperatures are permeable only for ultra-pure oxygen. The oxygen generator is constructed, tested and evaluated as the prototype of a serial device and will be able to serve approx. 15 patients (85 liters per minute).

CoClean-up

Highly efficient ambient air disinfection to contain the Coronavirus

Droplets and aerosols which contain the virus and are produced while breathing and talking are understood to be the main path of transmission for SARS-CoV-2. In a joint project, the Fraunhofer institutes IKTS and ITEM are developing a system that could be used to disinfect the air in enclosed spaces, such as hospitals, schools, restaurants or fitness studios. The system works based on the principle of electrochemical total oxidation, which completely destroys organic components, such as viruses. This also ensures that endotoxins or other products of the incomplete elimination of contaminants do not enter into indoor air, in particular when used in air conditioning or ventilation systems. Within the project, we are responsible for the overall system design and for developing ceramic diffusors and the electrochemical oxidation module.

Micro-PCR

Precisely adjustable thermal cyclers for quick detection of SARS-CoV-2

Laboratories testing for a Corona infection rely on PCR tests. To reduce testing times further in the future and be able to break up chains of infection sooner, IKTS is developing novel thermal cyclers. These help to heat and cool the sample material in a swift and precise way when reproducing and detecting the viral genetic code contained in the samples using the polymerase chain reaction. We combine several ceramic technologies for the new thermal cycler: Additive manufacturing processes are used to print the housing with integrated heating conductor structures, which are functionalized with ceramic heating pastes. This enables direct heat transfer and faster heating and cooling rates.

TO-G

Plasma disinfection of medical protective clothing

Plasma disinfection systems are used to disinfect protective clothing in the case of supply bottlenecks so it can be reused. However, the plasma electrodes used so far for this purpose are made of plastic and metal; they wear out quickly, limiting the use of this otherwise highly attractive method of disinfection. To solve this problem, we use electrically conductive ceramics for this functional core component, based on an innovative sintering technology for titanium oxides. These can, for one, reliably withstand the high electric voltage required for creating the plasma. Second, we can connect two functionally different electrode components in one single cost-efficient process step.

BioKomp

Quantitative biocompatibility testing for 3D-printed materials

3D-printed medical products make it possible to close supply gaps fast in a pandemic and create solutions for patient care (e.g. emergency ventilators, diagnostic consumable materials for acute cases). To be able to test 3D-printed plastic components in direct contact with cells/tissue, we are developing a novel biocompatibility test. The project aims to prove that it is possible, with our own developed in-vitro testing system "ClicKit-Well", to quantify cytoxicity in a direct cell test. This will enable medical professionals to evaluate risks and make a decision on the use of products made by additive manufacturing methods. The project team includes Leipzig University and Forschungs- und Transferzentrum Leipzig e. V. (FTZ). The partners cooperate with hospitals and the City of Leipzig.

COPERIMOplus

Personalized risk assessment models for heavy COVID-19 courses of illness

COVID-19 is causing significant problems for health systems, in particular with regard to the clinical treatment of severe courses of illness. A collaborative project aims to provide AI-based, individualized risk models which enable prognosticating such courses of illness. Fraunhofer IKTS contributes to the project with a platform for the statistical and quantitative evaluation of large, heterogeneous data sets. This includes using machine learning methods and enables synergetic support from other fields of application for data acquisition and risk models. Furthermore, we integrate other cross-sectional and pacemaker technologies in the data models, such as imaging analytics and automated data evaluation.