
Researchers Are Developing New Material for Planes and Cars That Will Show Damage Invisible to a Human Eye

2020-09-29

KTU researchers together with colleagues from Latvia, Denmark, Sweden, Slovakia, Ukraine, Czechia, Belarus and the US are developing multifunctional composite materials for aircraft, cars, wind power plants and other structure production. The international team of researchers aims at making the new material not only durable but also checking for errors invisible to the human eye.

According to Dr Daiva Zeleniakienė, a researcher at [Kaunas University of Technology \(KTU\)](#) Faculty of Mechanical Engineering and Design, advanced transport, aviation, wind turbines and other structures production from fibrous polymer composites is popular because the material is light and has excellent mechanical properties.

During exploitation, these structures are subjected to huge cyclical and impact load. It can lead to damage, such as cracks in the polymer matrix, layers or fibre ruptures, all of which can cause the deterioration of mechanical properties over time.

Worst of all, the above-mentioned damages are usually invisible, so it is difficult to predict what technical service to provide during the initial inspection that would also ensure cost-effectiveness and prevent dangerous decomposition of substances.

According to Dr Zeleniakienė, the team of researchers will develop new electrically conductive fibrous polymer composites, which will have excellent mechanical properties and self-diagnostic function.

“This will allow detecting damage without an additionally integrated sensor or using expensive contactless devices”, the researcher points out the economic advantage of the novel materials being developed also by the KTU scientists.

Will use nanoparticles created in the US

Colleagues from the US have created new electrically conductive nanoparticles that will be used for the composite material created by Lithuanian and other country researchers. MXene is a new group of metal carbides and/or nitrides characterised by a unique combination of metals electrical conductivity, hydrophilic surface and excellent mechanical properties.

“MXenes are nanoparticles recently created by our partners from [Drexel University](#) in the US. This scientific discovery is very important because the new material has already shown excellent, technologically useful properties at the early stages of the research”, – says Dr Zeleniakienė.

According to her, such particles will be mixed into an epoxy resin that is usually used for aviation, automotive and other industries production of composites. This will give more strength and durability to the structures.

“Also, installation of structural condition monitoring measures – based on the correlation between the development of errors and electrical parameters – will serve as a self-diagnostic tool for defect detection”, explains KTU researcher.

She notes that MXene particles used in research do not harm human health; particles released into the environment react with oxygen and form titanium dioxide that is used even in the food industry, for example, as white doughnut glaze.

Many perspectives in [Lithuania](#) as well

According to Gediminas Monastyreckis, a PhD student at KTU Faculty of Mechanical Engineering and Design, it is important that technological progress would be beneficial not only economically, but also would be environmentally friendly. Another science project on this topic – new hybrid fibre composer creation.

“With reinforced plastic composites, we can ensure durability, resistance to decomposition and fatigue, as well as additional functionality, such as excellent thermal, antistatic or electromagnetic interference shielding properties by using hybrid nanofillers, i.e. combinations of different nanoparticles with different properties”, explains the researcher.

“Although fibre composite industry in [Lithuania](#), compared to other European countries, is not

very well developed, I believe that our research will contribute to its' growth in [Lithuania](#)", says Dr Zeleniakienė.

According to scientists, the research on advanced multifunctional materials that reduce the measures and weight of structures and electronic devices, while ensuring the highest requirements for mechanical properties, environmental protection and durability, has grown significantly over the past decade.

They say that the biggest challenge that researchers and industry face today is the ability to identify materials that are needed for advanced production and everyday use; that is sustainable, from a new generation, cost-effective and energy-efficient.

Read the [original article](#) on Kaunas University of Technology.