

New Materials and Lightweight Construction

Dresden, Germany's Lightweight Construction Capital

Without future materials, industry innovations are unachievable. Only new materials make the manufacturing of products with completely new properties and functions possible. Dresden is Germany's "Lightweight Construction Center" and one of the most important regions for such materials within the country.

Whether the substances used are novel metallic structures, hybrid materials, composite materials made from fiber, ceramics, or materials with high temperature resistance, technological progress depends largely on new materials. A car, for example, needs to be lightweight to run on less gasoline, yet it must be stable to meet safety standards. And, the car should not be too expensive. Aircraft, prosthetics, medical instruments, even sports uniforms face increasingly bigger demands and new materials play a key role in meeting those demands. Lightweight composite materials like the ones researched and developed in Dresden, are contributing to a more sustainable use of energy and raw material resources.

High Demand for Holistically-Optimized Concepts

Built lighter, lightweight products have the same or even better functionality than classic industry materials. Lightweight construction is often considered a construction philosophy, but it's much more than that. It is the driving factor for innovations in many different industries. Using lightweight construction saves costs and raw materials, makes environmentally friendly production possible, and optimizes the entire process including recycling. Next to Industry 4.0 and electro-mobility, lightweight construction is of major significance to strategic innovation politics, and is part of the high-tech strategy of the German Federal Government.

As the largest German Lightweight Construction Cluster, Dresden sets Global Standards

As Germany's largest cluster for lightweight construction, Dresden sets global standards. Optimized forms created by functionally-integrated and hybrid-lightweight construction are used across all industries. Future trends are increasingly generated by combining diverse materials, among them hybrid and composite materials made from combinations of metals, alloys, plastics – especially fiber-reinforced plastics – ceramics and renewable resources. Lightweight construction robotics offers opportunities, particularly for innovative future-oriented fields such as Smart Factory and Smart Mobility.

In the lightweight construction sector, Dresden provides all parts of the supply chain, starting with the basic research for all types of materials like metals, plastics, natural materials and ceramics. In addition, there's construction, calculation and development of components, as well as processing technologies, serial production and quality control.

Dresden Research provides Answers to Global Industry Trends

In Dresden, two industry sectors, materials engineering and material science employ about 2,000 researchers. The Materials Research Network Dresden (MFD) unites 20 universities and institutes including the Fraunhofer, Leibniz, and Helmholtz Institutes.

TU Dresden – awarded “University of Excellence” as part of the German government's Excellence Initiative - and one of the leading universities in Germany and Europe has created a high-performance campus for lightweight construction. At its core is the Institute for Lightweight Construction and Plastics Technology (ILK), a research institute of the Faculty of Mechanical Engineering and the 'Friedrich List' Faculty of Transportation and Traffic Sciences of TU Dresden.

At the ILK, about 240 scientists perform research, teach, and work on basic and application-oriented research, and the concrete development of innovations for industry partners. The Dresden model of 'Function-Integrative Systems Lightweight Engineering in Multi-Material Design' is characteristic of the work at the Institute; the working model developed by the Institute's founder Werner Hufenbach has been in use since its invention in 1995. Every year, economics and science experts meet at the International Lightweight Construction Symposium, initiated by ILK in 1997. The symposium's central mission is to rapidly shorten developmental phases by using interdisciplinary approaches.

Another central organization, the Leichtbau Zentrum Sachsen (LZS) was founded as a spin-off of the ILK in conjunction with the TU Dresden-owned TUDAG Corporation, and, today, is part of the leading developmental partners in system lightweight construction in Germany. More than 60 engineers and technicians work together in interdisciplinary development teams that combine their expertise in aviation and automobile-and-vehicle construction with machine and plant engineering. Only recently, the LZS, together with its partners New Era Materials and Rolls Royce Germany, was awarded the AVK-Innovation Award (AVK – Federation of Reinforced Plastics-Innovation Award) for two revolutionary processes: a procedure for the manufacture of thermosetting composite structures, and a new fiber composite radial shaft for aircraft engines.

Cutting-edge Research in Nanotechnology and 3D Printing

The industry has high expectations for additive-generative manufacturing, also known as 3D printing. The process makes it possible to produce products time-and-cost-effectively. The Dresden Fraunhofer Institute for Material and Beam Technology (IWS) is one of the leading 3D printing centers worldwide.

As part of the Twenty20-Program, a partnering program for innovation, the Federal Ministry of Education and Research (BMBF) is funding the IWS-lead consortium, 'Additive-Generative Manufacturing – The 3D-Revolution in Product Manufacturing in the Digital Era' with 45 million Euro.

During the course of its Excellence Initiative, the BMBF established the Dresden Center for Nanoanalysis (DCN), which creates another technology platform for cutting-edge research at TU Dresden. Here, scientists research novel nanostructures with the progressive electron, ion, and X-ray microscopes. In their research, the scientists gain knowledge of the aging process of materials, for example, which help increase reliability of new products in automobile and communications electronics, and medical technology.

New Materials and Material Analysis for the Industry

EAST- 4D Carbon Technology has developed the 'Filament Winding Forming' procedure which can serially produce ultra-light, highly durable components made from carbon fiber-reinforced plastic (CFK), and that are of complex geometric design. The company designed the drive inflow cones for the Airbus A 350 XWB-900, the aircraft with the most efficient engine worldwide.

Dresden is virtually No. 1 in material testing: IMA Materialforschung und Anwendungstechnik test many of the newly-developed composite materials used worldwide. The testing technologies and systems developed by the company are used in aviation, railway vehicle, and automobile technology, as well as the metal and plastics industries.