



PRESS RELEASE

JEC Innovation Award for joint development of innovative sandwich design for lightweight structures

- Thermoplastic material structure and exceptionally efficient production technique
- Cycle times cut drastically from one day to 2.5 to 5 minutes per part

Wiesbaden, March 19, 2018. Lightweight materials and the techniques used to process them are constantly changing. One technique is to use composite materials in a sandwich structure in which an especially light core is combined with 'skins' of fiber reinforced plastic on both sides. As part of the "MAI Sandwich" research project, sponsored by the Federal Ministry of Education and Research of Germany, a consortium consisting of various renowned partners has spent the past two and a half years performing fundamental research in this area, developing an innovative, integrated sandwich structure concept for components made of composites in the aviation and automotive industries. The concept applies cutting edge thermoplastic material design with recycled carbon fibers combined with an exceptionally efficient production technique.

At the recent JEC World in Paris, the world's largest industry trade fair for composites, the partners were rewarded with a JEC Innovation Award in the category Aerospace Process for this development. The project was coordinated by the Chair for Carbon Composites at the Technical University of Munich. Additional partners of the project were Airbus, BASF SE, BMW, SGL Group, Foldcore, Neenah Gessner, Neue Materialien Bayreuth and Hofmann – Ihr Impulsgeber (Werkzeugbau Siegfried Hofmann).

Today, producing sandwich structures take a great deal of time, making it expensive. In traditional processes, producing a standard generic component could take a cycle time of up to one day. This project has revealed that these long cycle times can be reduced drastically to 5 minutes for a comparable component in the aerospace industry and to 2.5 minutes for a similar component in the automotive sector. Optimal integration of the different components, including fusion bonded thermoplastic materials between the core and skins, makes this result possible. . Furthermore, the partners developed an innovative, fine-tuned production sequence using the three techniques of thermoforming, injection molding and fusion bonding in a primarily automated working facility. The process was realized and demonstrated on Neue Materialien Bayreuth's 2,500 t compression and injection molding machine using a novel tool concept by Hofmann – Ihr Impulsgeber.

Components with a sandwich structure enable especially lightweight and sturdy designs. These properties make them ideal for secondary structures such as floor paneling or interior lining of aircraft or underbody or seat back panels in automobiles.

Contact for questions:

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About Technical University of Munich | www.tum.de/en

The Technical University of Munich (TUM) is one of Europe's leading research universities, with around 550 professors, 41,000 students, and 10,000 academic and non-academic staff. Its focus areas are the engineering sciences, natural sciences, life sciences and medicine, combined with economic and social sciences. Nobel Prize winners and inventors such as Rudolf Diesel, Carl von Linde, and Rudolf Mößbauer have done research at TUM. In international rankings, TUM regularly places among the best universities in Germany.

The Chair of Carbon Composites was founded in May 2009, with a focus on carbon-fiber composite materials and their applications. The appointment of Professor Drechsler was made possible by the foundation of a Chair by the SGL Group and a TUM investment with funding from the German Excellence Initiative.

The LCC takes an interdisciplinary approach to research, extending from the raw materials through implementation of manufacturing technologies to complete composite components. With specially developed simulation methods, the composite manufacturing process chain can be represented virtually. Furthermore, the established approaches are constantly expanded by new research topics. Currently, for example Additive Manufacturing Methods are increasingly being developed as a driver for innovation of individualized fiber reinforcement and combinations with composite structures.

About Airbus | www.airbus.com

Airbus is a global leader in aeronautics, space and related services. In 2017 it generated revenues of € 67 billion and employed a workforce of around 129,000. Airbus offers the most comprehensive range of passenger airliners from 100 to more than 600 seats. Airbus is also a European leader providing tanker, combat, transport and mission aircraft, as well as one of the world's leading space companies. In helicopters, Airbus provides the most efficient civil and military rotorcraft solutions worldwide.

About BASF | www.basf.com

At BASF, we create chemistry for a sustainable future. We combine economic success with environmental protection and social responsibility. The more than 115,000 employees in the BASF Group work on contributing to the success of our customers in nearly all sectors and almost every country in the world. Our portfolio is organized into five segments: Chemicals, Performance Products, Functional Materials & Solutions, Agricultural Solutions and Oil & Gas. BASF generated sales of €64.5 billion in 2017. BASF shares are traded on the stock exchanges in Frankfurt (BAS), London (BFA) and Zurich (BAS). Further information at www.basf.com.

About the BMW Group | www.bmwgroup.com

With its three brands BMW, MINI and Rolls-Royce, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles and also provides premium financial and mobility services. As a global company, the BMW Group operates 30 production and assembly facilities in 14 countries and has a global sales network in more than 140 countries. In 2015, the BMW Group sold approximately 2.247 million cars and nearly 137,000 motorcycles worldwide. The profit before tax for the financial year 2015

was approximately € 9.22 billion on revenues amounting to € 92.18 billion. As of 31 December 2015, the BMW Group had a workforce of 122,244 employees. The success of the BMW Group has always been based on long-term thinking and responsible action. The company has therefore established ecological and social sustainability throughout the value chain, comprehensive product responsibility and a clear commitment to conserving resources as an integral part of its strategy.

About the SGL Group – The Carbon Company | www.sglgroup.com

The SGL Group is a leading manufacturer worldwide of products and materials made from carbon. The extensive product portfolio ranges from carbon and graphite products, carbon fibers all the way through to composites. The SGL Group's core expertise comprises the control of high-temperature technologies as well as the deployment of many years' application and engineering know-how. This is used to exploit the company's wide materials base. These carbon-based materials combine a number of unique material properties such as very good conductivity of electricity and heat, resistance to heat and corrosion as well as lightweight construction coupled with high firmness. The SGL Group's products are deployed in the automotive and chemicals industries as well as in the semiconductor, solar, LED industry segments and in the field of lithium-ion batteries. Carbon-based materials and products are also used in wind energy, aviation and space travel as well as in the defense industry. With 32 production locations in Europe, North America and Asia as well as a service network in over 100 countries, the SGL Group is an enterprise with a global orientation. In the 2017 financial year, approx. 4,200 employees generated 860.1 million euros in sales revenue. Its Head Office is based in Wiesbaden / Germany.

About Foldcore GmbH | www.foldcore.com

Our unique, patented technology enables the efficient and fast manufacture of advanced folded core structures for next-generation sandwich applications. A multitude of base materials is transformed quickly and economically by cutting-edge folding technology into high-performance cellular materials. A host of industries benefit from Foldcore® application, including aerospace, automotive, shipbuilding as well as rail- and civil engineering. We help you to build lighter, highly integrated and customized sandwich products with unique properties.

About Neenah Gessner | www.neenahfiltration.com

Neenah Gessner has been producing technical media for over 50 years at the Bavarian locations Bruckmuehl and Feldkirchen-Westerham. Today, more than 630 employees work at the two mills and form the basis for the company's success. With its materials, Neenah Gessner covers a wide range of applications. With different fibers (cellulose, synthesis, glass and carbon) and technologies, media are created that are indispensable in everyday life. Both in the automotive sector to protect people and components, as well as in the industrial sector, where even the highest demands must also be met. As an international company Neenah Gessner delivers customized solutions worldwide.

About Neue Materialien Bayreuth GmbH | www.nmbgmbh.de/en

Neue Materialien Bayreuth GmbH is a non-academic research company developing novel materials and processing solutions especially in the field of polymer foams and fibre reinforced composites. We provide application-oriented solutions by optimizing available materials and production processes. The results of this approach are ready-to-use and profitable solutions, due to the application-related research and development made by NMB.

About Hofmann - Ihr Impulsgeber | www.hofmann-impulsgeber.de/en

Hofmann - Ihr Impulsgeber is a renowned specialist for mould making and machine engineering. The development and manufacturing of complex injection moulding tools is one of the company's main competences. From the design to the manufacturing of the moulds, Hofmann is providing everything from a single source and offers solutions for nearly every injection moulding technology. For the last few years the machine engineering division of the company has grown significantly. In this business unit, Hofmann is offering solutions for standardized and custom made machines. Both business units are also using their know-how in order to realise combined projects, for example injection moulding automation. Research

and development has a high significance in the company. Together with partners from industry and science, Hofmann is working on new processes and the optimization of existing technologies. Founded in 1958 in Lichtenfels, the 3rd generation family owned business is employing about 400 people.

Important note:

To the extent that our press release contains forward-looking statements, the latter are based on information that is available at present and on our current forecasts and assumptions. Forward-looking statements, by their very nature, entail known as well as unknown risks and uncertainties that may lead to actual developments and events differing substantially from the forward-looking assessments. Forward-looking statements must not be understood to be guarantees. Instead, future developments and events depend on a large number of factors; they comprise various risks and imponderables and are based on assumptions that may possibly turn out not to be appropriate. These include unforeseeable changes to fundamental political, economic, legal and societal conditions, particularly in the context of our main customers' industries, the competitive situation, interest and exchange rate trends, technological developments as well as other risks and uncertainties. We perceive additional risks e.g. in pricing developments, unforeseeable events in the environment of companies acquired and Group member companies as well as in current cost savings programs from time to time. The partners assume no obligation and does not intend to adjust or otherwise update these forward-looking statements either.

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