

Stuttgart / Stuttgart, July 6th, 2021

## PRESS RELEASE – ThinKing July 2021

### Induction 2.0: Precision heating

In the past, repairing lightweight components made of fibre composite plastics was a complex, cost-intensive process. The ThinKing for July changes that process on a fundamental level. Inductive, contour-specific heating of surfaces using FlexIn Heat Technology from msquare GmbH makes repairs easy. This significantly extends the service life of fibre-reinforced components. In addition, the technology creates new possibilities in forming and joining fibre composite plastics.

*The Baden-Württemberg State Agency for Lightweight Design will present the ThinKing for this innovation in July of 2021. Each month, Leichtbau BW GmbH uses this label to award innovative lightweight design products or services from Baden-Württemberg.*

#### At a glance:

- ▼ **Climate and resource conservation:** Repairing lightweight components made of fibre composite plastics extends their service life.
- ▼ **Energy-efficient:** Contour-specific, homogeneous heating with comparably low energy use.
- ▼ **Flexible:** Inductive heating technology can be used not only to repair bent structures in fibre composite plastics, but also for forming and joining.
- ▼ **Material preservation:** Homogeneous heating avoids cold spots or overheating.
- ▼ **Time-saving:** High heating rates and precise temperature management cures the resin through a controlled process.

Lightweight design is facilitating forward-thinking, energy-efficient and climate-friendly mobility. Lightweight components made of fibre-reinforced plastics are an especially good choice for preserving the climate if their service life can be extended through repairs, to ensure they function reliably for as long as possible.

However, repairs of these lightweight materials are difficult, and often cost-intensive. An innovative technology from msquare GmbH solves this problem. FlexIn Heat multiplies the climate-protecting impacts of lightweight construction with fibre composite materials.

“We offer a solution consisting of just a few, easy to handle components, that allows for quick and efficient repairs of composites at temperatures of up to 400 °C. Even structures with curved surfaces are accessible for repairs with our technology” says Sonja Geenen, who is responsible for distribution at msquare GmbH, explaining the idea behind the new process.

## **Easily repair lightweight components**

FlexIn Heat technology can easily be used to make repairs: First, damaged areas are scarfed, in order to attach a repair patch to the damage using an adhesive film. The next step is to cut a thin piece of sheet metal or mesh to match the contour, which is then placed on top of the damaged area.

The last, and most important layer is the FlexIn Heat induction blanket, a flexible silicone blanket with an internal support fabric that is attached to the patented, flexible induction coils. Vacuum pressure is applied to suction the air from pre-defined channels on the edge of the heating blanket, allowing it to press close against the composite surface. This creates an air-tight seal around the repaired area and creates the required pressure.

Voltage is connected to heat up the panel – the susceptor – through inductive eddy currents. The vacuum creates the necessary pressure to allow the repair patch to create a firmly bonded connection with the surrounding material of the component, and allow the resin used to cure more quickly due to the heat and pressure.

Magnetic and non-magnetic metals can be used as susceptors, in the form of sheets, films or mesh, as well as carbon fibres in the form of tissues or scrims. The generator and control and regulation unit is housed in a mobile repair unit for the user. This means the technology can be used wherever it is needed.

## **Energy-efficient, precise and gentle on materials**

The inductive functional principle behind FlexIn Heat is as simple as it is energy-efficient: Because the sheet of metal is cut to match the damaged area, only the damaged part of the component is heated. This means that heat is only produced where it is needed.

The inductive heating process can generate much higher localised temperatures than previous large-surface heating processes, meaning it is also suitable for high-performance thermoplastics like PEEK, LM PAEK, PPS, PEI, PA, and PEKK.

The susceptor is cut precisely to size, meaning that only the necessary areas are heated. Other, potentially more temperature-sensitive areas, are protected. Direct heating of the carbon fibres embedded in CFRP (carbon fibre reinforced plastics) is even possible.

The technology is supported by a wide range of intelligent sensors and a modern, WiFi-based operating concept, allowing users to precisely control the heating process on a mobile device using an app, as well as create comprehensive quality assurance documentation. The latter is necessary, in particular, for safety-relevant components, such as in the aviation field.

## **Accelerating processes with induction**

Around 70% of damages sustained on aeroplanes are on the base of the plane, during maintenance, or during take-off and landing due to foreign objects kicked up on the runway. Currently, FlexIn Heat technology is primarily being used in the aviation industry and on wind turbines.

For example, one concrete application in the aviation industry is applying localised heat to reduce the curing time for epoxy resin by five to six hours – compared to the previous process, where the resin was cured at room temperature.

## **Variable process with broad range of potential applications**

In the future, fibre-reinforced (thermoplastic) synthetic materials will likely be used even more in electric vehicles or urban-air mobility, resulting in many new applications for the technology.

However, the technology can also be used in more ways than just for making repairs. It is also suitable for reworking composites like CFRP or GFRP. This technology could be used to precisely heat tools out of the autoclave for manufacturing lightweight components. This facilitates quick reactions and controlled variothermal process management.

In addition, inductive heating can also be used to join composite components with metals, for instance, to manufacture hybrid lightweight components with firmly bonded material connections.

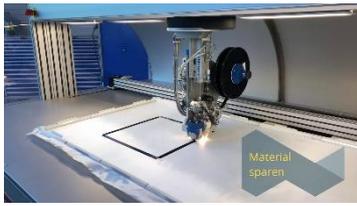
The msquare GmbH team continues to seek out new and challenging applications to develop the technology, and to seek out users and partners from the aviation and aerospace, automotive, composite manufacturing, tool and mould production, and wind energy industries, as well as anywhere process heat plays a role – such as in food technology.

---

## **About msquare GmbH**

Innovative heating technology is msquare GmbH's area of expertise – a young company founded by the Deutsches Zentrum für Luft- und Raumfahrt DLR e.V. (German Aerospace Centre).

Patented FlexIn Heat technology and intuitive control units can optimise any heating process in a flash.



### ThinKing video

We present the ThinKing to you briefly in our new video series  
“**Lightweight design made easy.**”  
<https://youtu.be/t0VKOMz8fNI>

### Visual materials



Repairing a fibre composite structure: The mobile repair unit is visible at the top right, and the heating blanket is placed straight on top.



Clearly visible: The sheet is cut to size as a susceptor to deliver targeted heat to the damaged area.

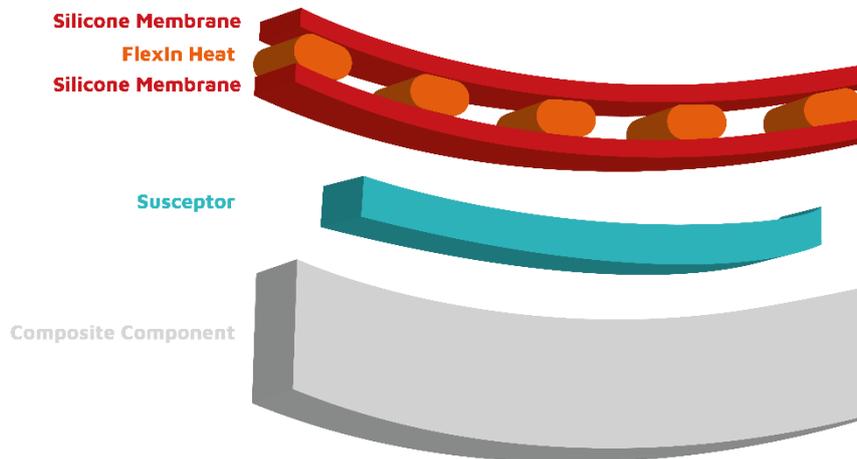
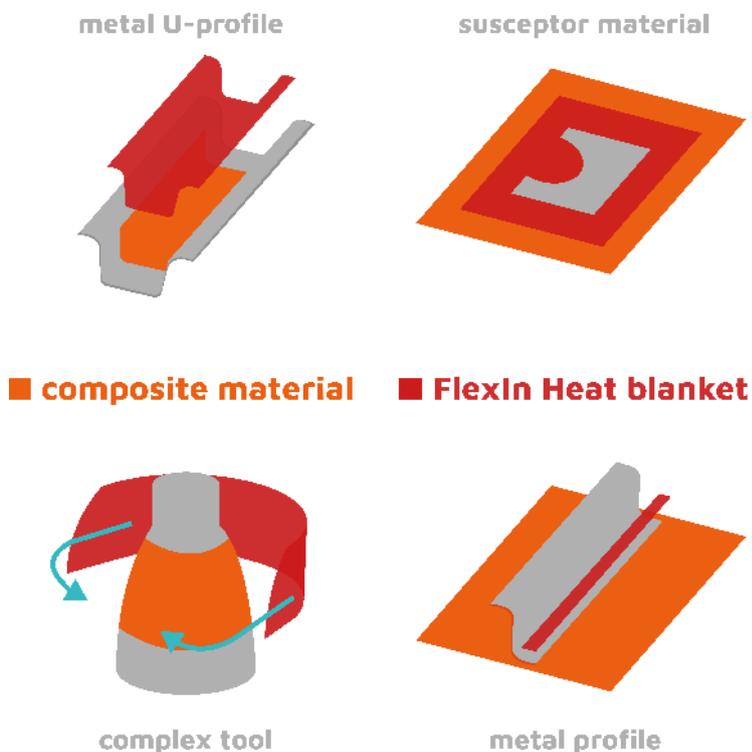


Diagram and layer structure of FlexIn Heat technology



Precise contours – even in three dimensions: Curved surfaces are no obstacle to FlexIn Heat, and the flexible induction blanket can adapt to almost any geometry.

Source: msquare GmbH, reprints free of charge.

**Editorial contact:  
Your contact person at the State Lightweight Construction Agency of Baden-  
Württemberg**

Carina Konopka  
Communication Manager  
Breitscheidstraße 4  
70174 Stuttgart  
Tel.: +49 711 – 128 988-44  
Mobile: +49 151 – 1171 10 02  
[carina.konopka@leichtbau-bw.de](mailto:carina.konopka@leichtbau-bw.de)  
[www.leichtbau-bw.de](http://www.leichtbau-bw.de)

If you would like to use this press release in your reporting, please send us a brief notice and/or copy of the article. You are welcome to contact us if you are interested in a technical article or a specific topic. If you have any questions, we would be happy to answer them at any time, or put you in touch with a contact person from our network of over 2,100 companies and 290 research institutions – probably the world's largest lightweight construction network.