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LEISTER laser technology in the EU-funded project FlexHyJoin

Lighter vehicles, airplanes and space shuttles all require less fuel, making them more economical. In electric mobility, weight has an influence on the range that can be covered with one battery charge. Therefore, the weight of a vehicle in the automotive and aerospace sector is an enormous economic factor. Lightweight design is the key word.

Multi-material design is becoming more important

With current climate conventions in politics especially for the automotive industry, lightweight design becomes more important. Metal-plastic hybrid joints are intended to reduce weight, as plastic is lighter than metal. These new material combinations require new or adapted joining processes.

EU-funded project "FlexHyJoin"

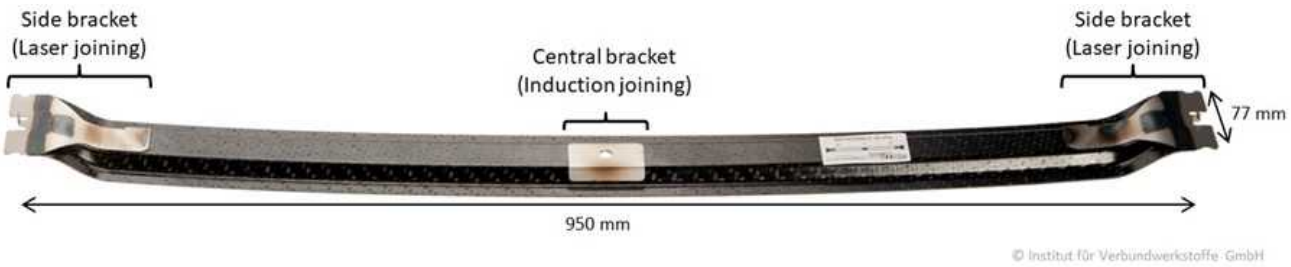
The project FlexHyJoin (**Flex**ible production cell for **hy**brid **join**ing) was launched as a part of the EU research program Horizon 2020 and is funded by the EU.

Horizon 2020 has the overall objective of securing Europe's global competitiveness, boosting economic growth and creating jobs.

What's it about? FlexHyJoin is an abbreviation and stands for flexible production cell for hybrid joining. Within the project the prototype of a fully automated production cell will be developed, which includes a three-stage process chain for joining metal to plastic components.

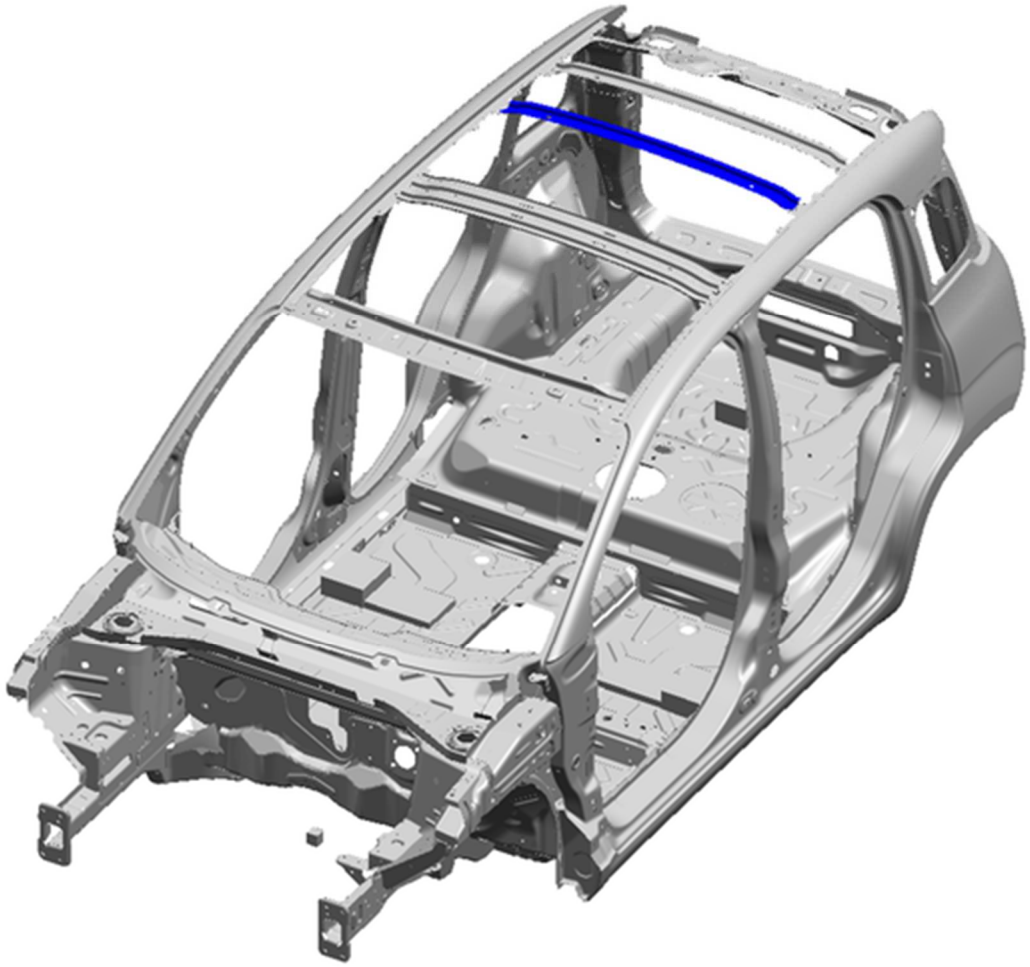
The production cell not only includes laser joining for complex geometries from Leister Technologies AG, but also induction joining, laser structuring of metal surfaces and nondestructive testing of the joint for a good and reliable strength. In addition to the process development for the individual systems the project focuses on flexibility and automation. To illustrate the process, the following component is joined in the production cell.

Fiber-glass reinforced plastic instead of sheet metal



The produced demonstrator component - as shown above - is the roof stiffener of a car (model Fiat "Panda") of project partner CRF. To reduce weight the roof stiffener, which is currently made entirely of metal, is replaced by glass-fiber reinforced plastic and three metal sheets. For better visualization, the roof stiffener was colored blue in the following

picture. The two, mirror-inverted side brackets form the link to the car body and are joined to the plastic component by Leister's laser system. The central bracket is the link to components of the vehicles interior.



Model Body Fiat Panda with roof stiffener (blue)

Leister Technologies AG develops laser joining system

Leister's main task within the project involves the development of the laser joining system to take the feasibility studies of a previous project called “Ybridio” from laboratory to serial scale. Therefore, the process needs to be adapted to the complex, three-dimensional geometry of the roof stiffener with regard to the correct irradiation and pressure distribution.

How is the plastic joined to the metal?

Small structures are introduced into the metal surface with a laser. In this case they are drop-shaped cavities. This part of the process is taken on by Fraunhofer Institute for Laser Technology and is shown in the embedded link later in this article.

After the metal is prepared, the fiber-glass reinforced polymer is melted using Leister's laser and pressed into the cavities of the metal surface. As soon as it has filled the structures and cooled down, a mechanical metal-plastic connection is formed.

In the past, the entire component was made of metal. By replacing parts of the metal with plastic, the component is about 30 percent lighter. If more components of the vehicle are made of metal and plastic, this results in a total weight reduction, which certainly has an influence on fuel consumption.

The Video shows the sequence of the whole process chain – partwise shortened respectively accelerated.

The process depends on the properties of the material being used

In general, the process depends on the material characteristics of the components. On the polymer side the transparency for laser radiation is an important factor. If the polymer is non-transparent, the samples must be irradiated from the metal side – like in this project - which leads to a higher significance of the metals surface.

As a competitive process to adhesion, this process gets along with low cycle times and no additional material.

From the beginning of 2019, the production cell will be presented to potential customers

The FlexHyJoin project will be completed by the end of 2018. Afterwards, the production cell will be located at the Gubesch Group in Wilhelmsdorf (near Nuremberg, Germany) for a minimum of three years. Within this time, the project partners have the possibility to present the production cell to potential customers.

For more detailed information about the project and its participants, please visit www.flexhyjoin.eu or read this documentation.

Project partner

CRF Centro Ricerche FIAT S.c.p.A., Italy

EDAG Engineering GmbH, Germany

FILL Gesellschaft m.b.H., Austria

Fraunhofer ILT, Germany

Fundación Tecnalia Research & Innovation, Spain

HBW-Gubesch Thermoforming GmbH, Germany

Institut fuer Verbundwerkstoffe GmbH (Project Coordinator), Germany

KGR S.p.A., Italy

Leister Technologies AG, Switzerland

New Infrared Technologies S.L., Spain

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