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HYBRISONIC

Ultrasonic Supported Joinning of Hybrid Materials (MPC: Metal – Polymer - Composites)

Welding of unweldable? Yes - it's possible!

The undertaking is funded by

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HR EXCELLENCE IN RESEARCH

Evaluated by IEP INSTITUTIONAL EVALUATION PROGRAMME www.iep-qaa.org

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The Idea

HYBRISONIC is an innovative welding technology that enables reliable joining of Metal Polymer Composites (MPCs), previously considered unweldable.I t uses high-power ultrasonic vibrations to locally soften and remove the polymer layer that blocks electrical current flow.

Once the metal layers make contact, resistance welding creates a strong and durable joint. **This single-station process integrates both ultrasonic and welding functions,** making it practical and scalable for industry.

HYBRISONIC opens new possibilities for lightweight, high-performance structures in automotive, aerospace, and space applications.

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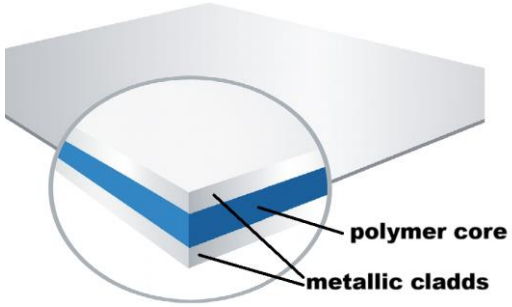
Problem & Solution

Problem: MPC – Strong Potential, Tough Joining Challenge

- Metal Polymer Composites (MPCs) offer low density, high stiffness-to-weight ratio, and excellent mechanical performance.
- Their structure (metal–polymer–metal) makes them **difficult to join** using standard welding.
- The polymer core acts as an **insulating barrier**, blocking current flow and preventing the use of common techniques such as resistance welding.
- As a result, industry relies mainly on mechanical joining (rivets, screws, clinching), limiting design freedom and performance.



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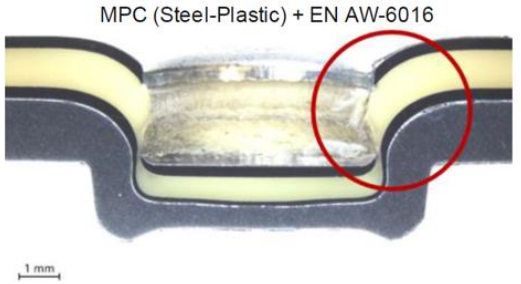

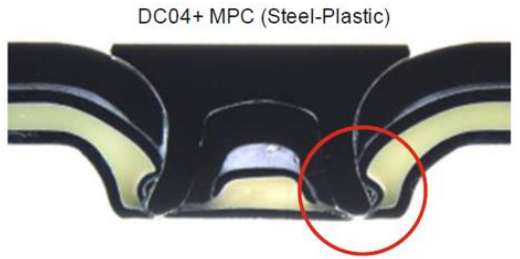

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Problem & Solution

Solution:

- Ultrasonic Supported Joining **HYBRISONIC** eliminates the welding barrier by using high-power ultrasonic energy directly on the welding tool, which also functions as an electrode.
- **Ultrasonic vibrations heat, soften and expel the polymer locally**, allowing the metal layers to contact directly.
- Final resistance welding creates a strong, durable joint that meets engineering requirements.
- Prototype testing confirmed **HYBRISONIC** is effective and ready for industrial use.

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Innovation

Solution:

Turning MPC into a Weldable Material – A Game-Changing Breakthrough

- First solution enabling true welding of MPC materials rather than mechanical fasteners.
- Controlled ultrasonic energy + resistance welding integrated into one workstation.
- Intelligent control system allows precise tuning of ultrasonic and welding parameters.

One station! Two technologies! Many possibilities!

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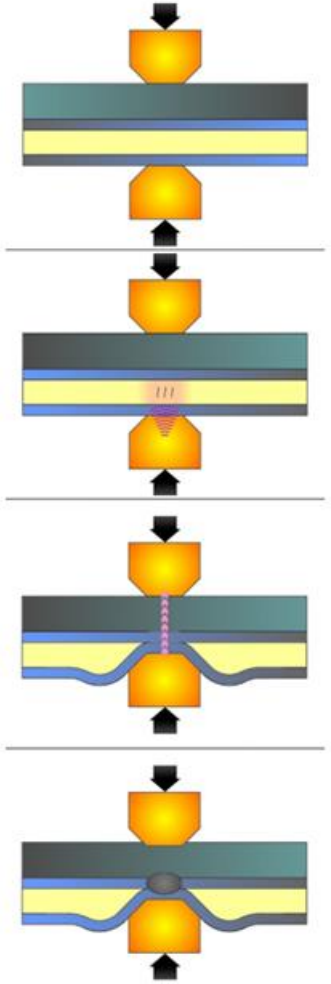
Innovation



1) INNITIAL WELDING PRESSURE

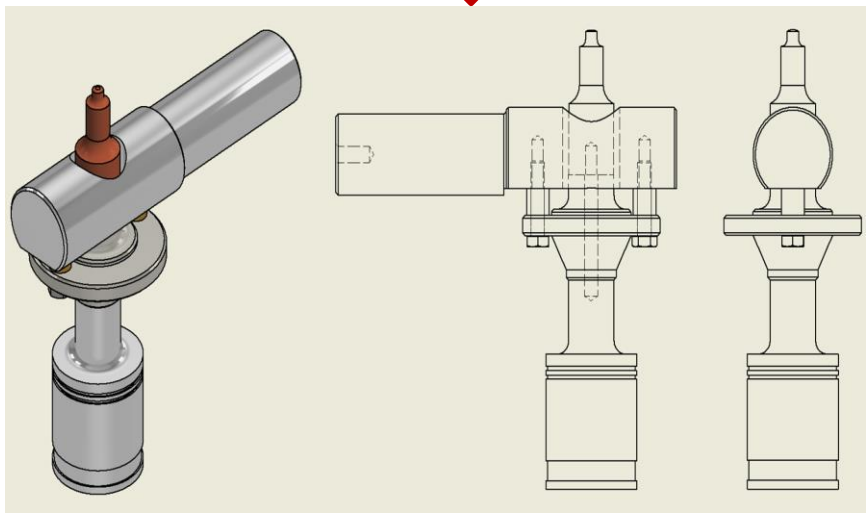
2) PLASTICIZING OF POLYMER USING HIGH POWER ULTRASOUNDS

3) METALLIC CONTACT OF CLADDS, CURRENT FLOWS

4) HIGH STRENGTH WELDING JOINT

welding sequence

Working tool concept



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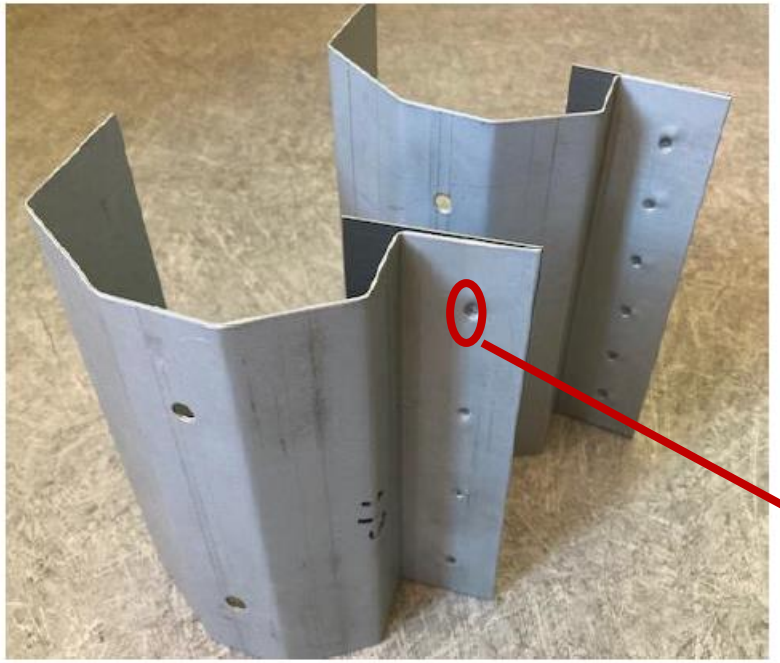
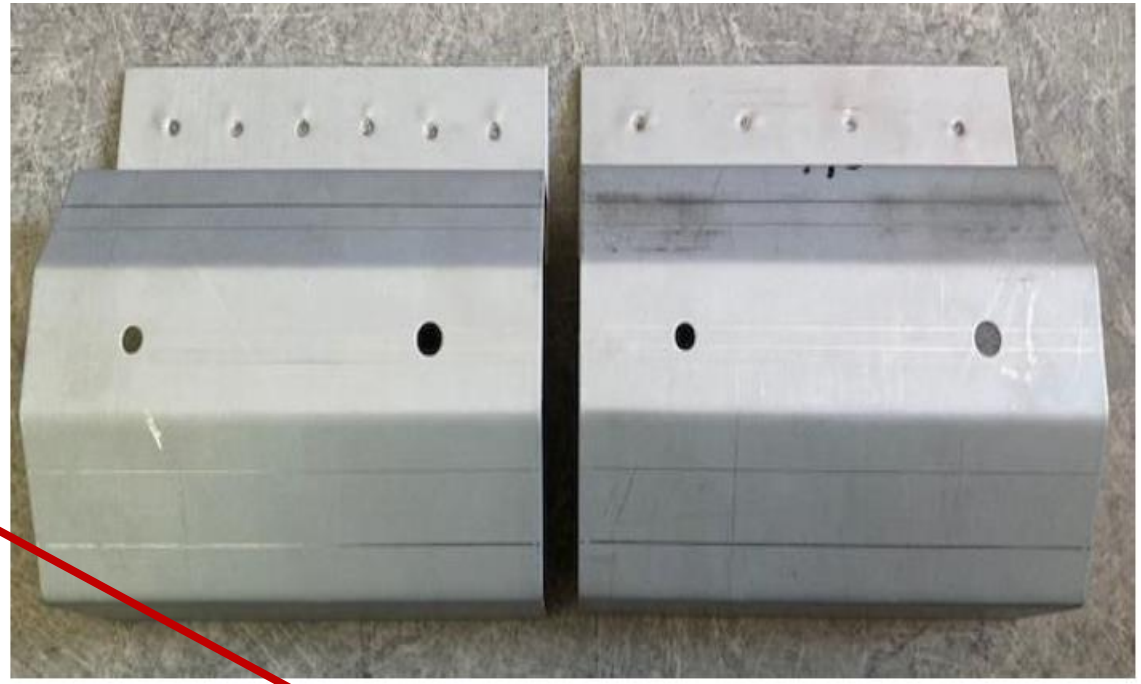
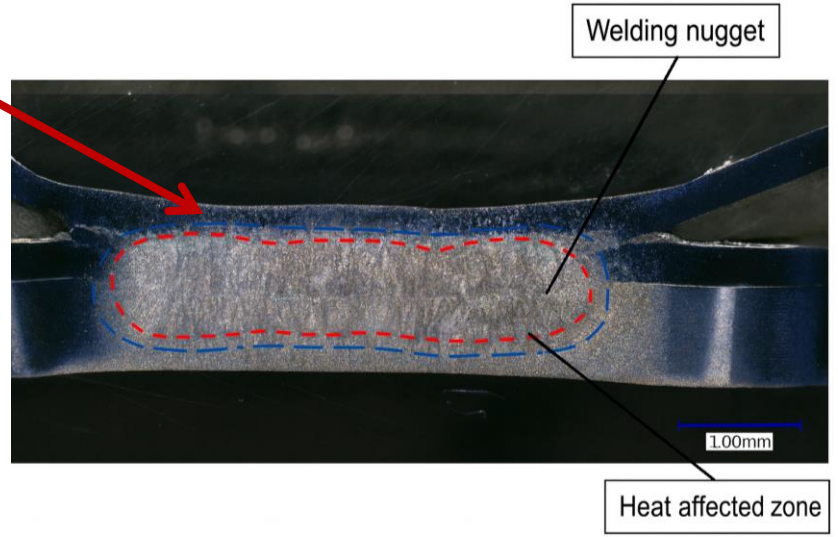
Innovation







High quality joinned components ready to use

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Innovation

Possibility of joining MPMS/MPC composite sheets with conventional materials, e.g. steel/aluminium sheets,

Possibility of one-sided welding of MPMS/MPC composite sheets,

Elimination of mechanical connection (e.g. clinched connections, blind riveting without holes).

prototype setup

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Market opportunity

Expanding the Use of Lightweight Hybrid Materials

- Automotive: lightweight structures, improved efficiency, reduced emissions.
- Aerospace & space: high-strength, low-mass components meeting strict safety requirements.
- Industry demand for hybrid materials is growing, but lack of welding methods has been a major barrier.
- **HYBRISONIC** removes this barrier, enabling wider adoption of MPCs in high-volume and high-performance applications.
- Offers manufacturers design freedom, cost reductions, and material efficiency, creating strong commercial potential across multiple sectors.

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Technology Readiness and IP Status

IP STATUS

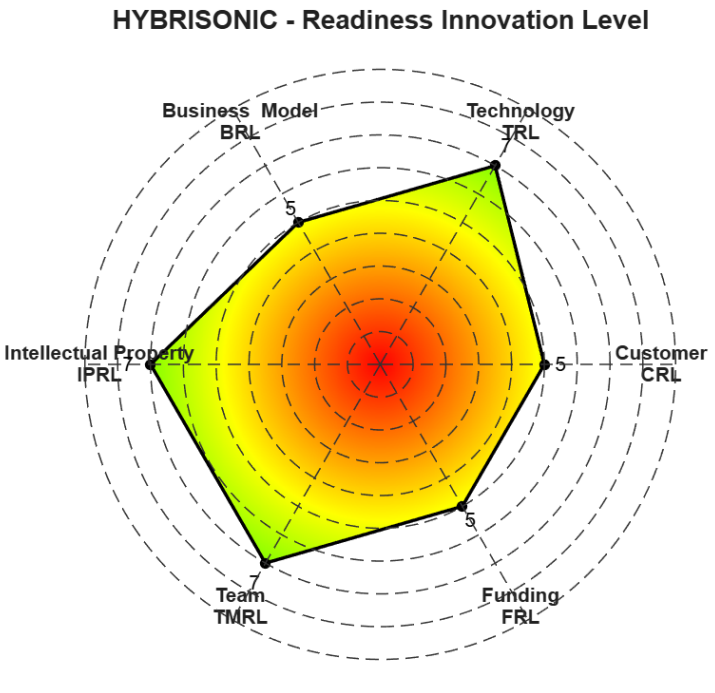
- ☒ Patent application
- ☐ Patent
- ☒ Know-how
- ☐ Other

COMMERCIALISATION FORM

- ☒ Sale
- ☒ Implementation contract
- ☒ Granting a license
- ☐ Spin off
- ☒ Other contract

LEVEL OF IMPLEMENTATION READINESS

- ☒ A concept and a theoretical model
- ☒ An experimental validation of the concept
- ☒ Initial technology / demonstrator
- ☒ Tests in the laboratory conditions
- ☒ Tests in real conditions
- ☒ Final technology / prototype
- ☐ A technology verified in the operational conditions



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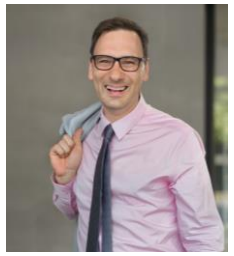
Research Team & Contact information



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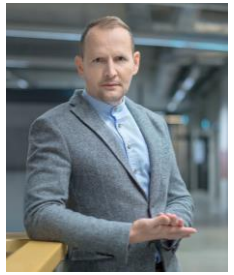

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