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STUDY OF THE ULTRASONIC WELDING OF A POLYCARBONATE-GLASS FIBER LAMINATE AND COMPARISON WITH ADHESIVE BONDING

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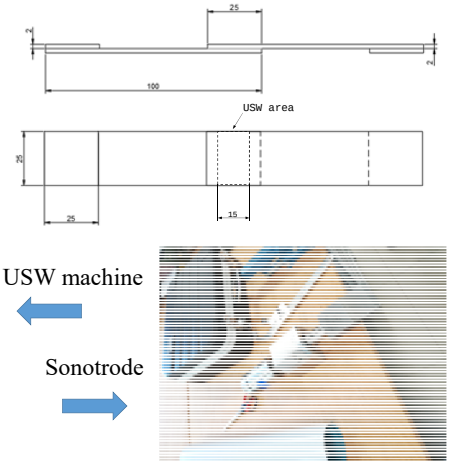
Motivation and objectives

UltraSonic Welding (USW) offers several advantages in joining thermoplastic composites, such as low welding time, cleanliness and reliability and safety for the environment and operators. Yet, PC-based composites did not find attention regarding USW.

This work is therefore aimed at exploring the USW of a composite laminate made of **polycarbonate reinforced with continous glass-fibres (PC-GF)** by:

- a **Design of Experiment (DoE)** in order to find the optimal **Weld Force (WF)** and **Weld Energy (WE)**
- experiments **with and without an Energy Director (ED)** in the form of a neat polycarbonate wire
- a **comparison with adhesive bonding (AB)**

Experiments

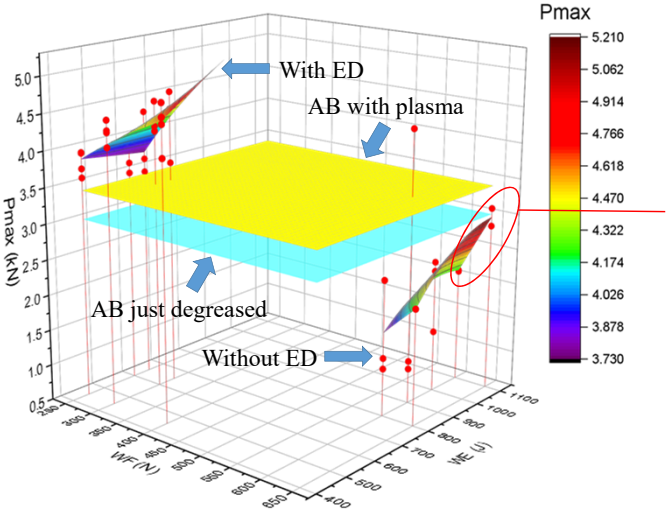


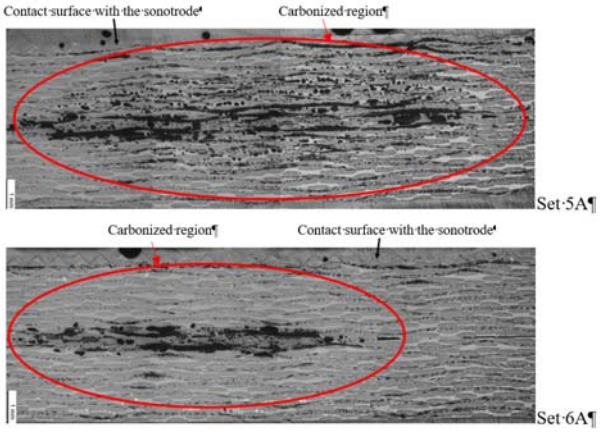
- Tencate Cetex® TC925 FST PC-GF 8H satin weave

Test	Value
Tensile Strength	463.2 MPa
Tensile Modulus	23.7 GPa
Compressive Strength	446 MPa
Compressive Modulus	26.9 GPa
Flexural Strength	728.7 MPa
Flexural Modulus	26.4 GPa

- [0/45/-45/45/0]s layup
- Loctite HY 4090 hybrid cyanoacrilate/epoxy adhesive
  - fixing time < 180 s; cure time > 72 h on PC
  - expected shear strength on PC: 6.9 MPa
- AB surface treatment:
  - degreased only
  - degreased + atmospheric plasma

Results





Conclusions

- Welding without ED is possible, but in any case the use of an energy director works better although this complicates the procedure.
- Without ED, the increase in P_{max} is lower as te WF and WE increase, due to local burn-out of the PC
- The strength values are, in the casewith ED, is higher than that obtained with a structural adhesive
- Overall, USW is therefore a convenient joining method for this type of thermoplastic composite