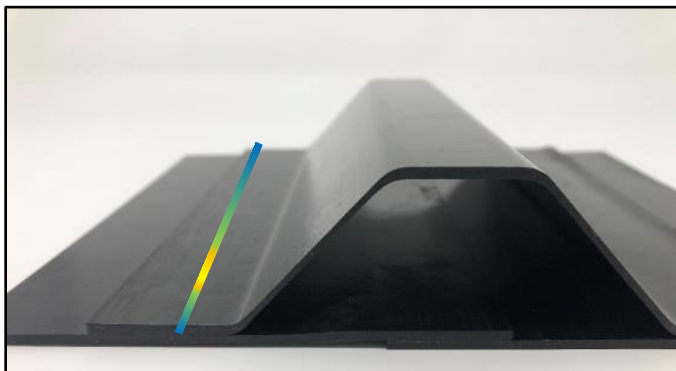


Opportunity

- Thermoplastics offer the possibility of fastener-free composites assembly
- Joint quality is directly proportional to the control of processing variables (temperature and pressure)
- Thermocouples are intrusive and sensitive to the induction and resistance welding processes
- Line-of-sight technologies cannot measure between the parts at the weld interface



Solution

- A single fiber sensor can be used to monitor temperature along the entire weld
- Optical fiber is non-conductive, hence inherently safe
- The sensors are minimally invasive with a diameter of 0.165 mm
- Fiber sensors are immune to EMI and require no additional shielding
- Temperature measurements are used to control the induction current
- Active control ensures ideal welding parameters are achieved
- Forward process models increase reliability and reduce manufacturing time

Benefits

- Reduce waste by improving process control
- Decrease development time for new part geometries
- Increase safety by ensuring each part is joined properly

Commercial aircraft of all sizes are incorporating designs similar to the one shown on the left. These structures are composed of reinforced thermoplastics that are joined using the induction welding process



Composites



ODiSI



Temperature



Protection



Software



McNAIR Center

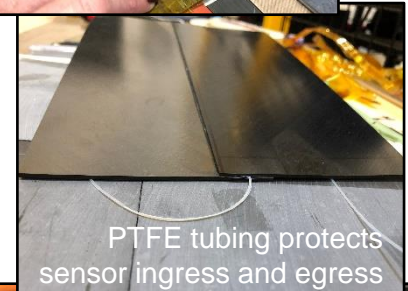
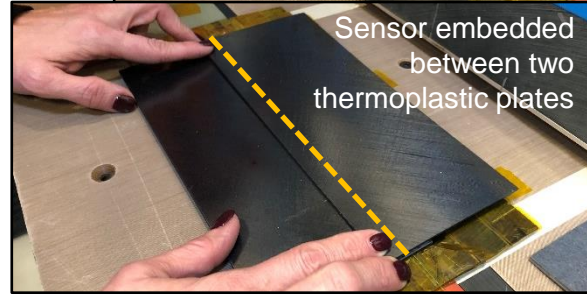
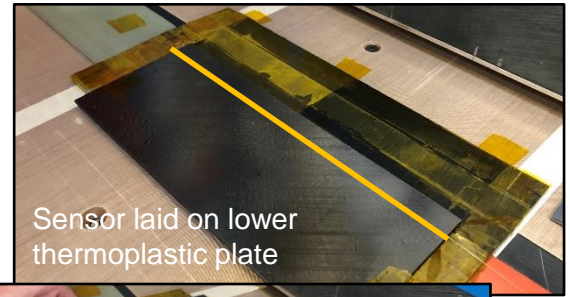
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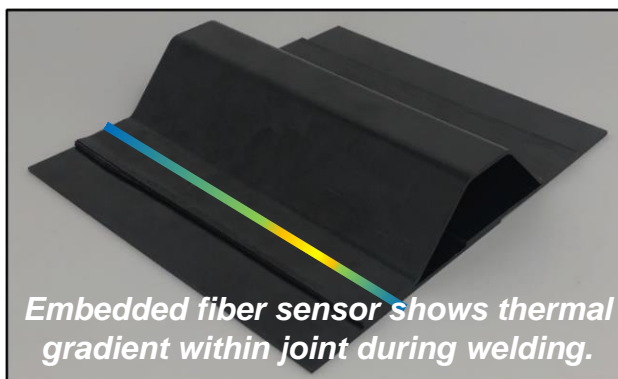
Process

- Determine placement of the sensor so that it falls within the welded area
- Ensure sensor ingress and egress is protected e.g. using PTFE tubing
- Ensure the sensor leads are not going to be impacted by pressure application or the part edges coming together
- Map sensor location to the part using system software
- Configure measurement streaming to the control of the welder
- View in real-time the temperature profile along the sensor and at individual locations in the ODiSI control software



Result

- A well joined part with an embedded sensor that can provide spatially distinct temperature measurements at the weld line



Abdul Rahim et. al. In-Situ Monitoring and Control of Induction Welding in Thermoplastic Composites using High Definition Fiber Optic Sensors. CAMX 2019.

