Affordable Thermoplastic Matrix CFC / Metallic Framework Structures Manufacture

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CIMComp EPSRC Future Composites Manufacturing Research Hub

Background

Stiffness critical frameworks using CFC struts and metallic joints can be extremely light weight – but bonded joints are problematical for life critical structures

Aims

Investigate the feasibility of manufacturing exceptionally lightweight framework structures appropriate for >5000 P.A. production using hybrid CFRP / Metals

Identify and investigate potential solutions for:

- **Weight, manufacturing rate and automation potential**

Sports Car Engine frames

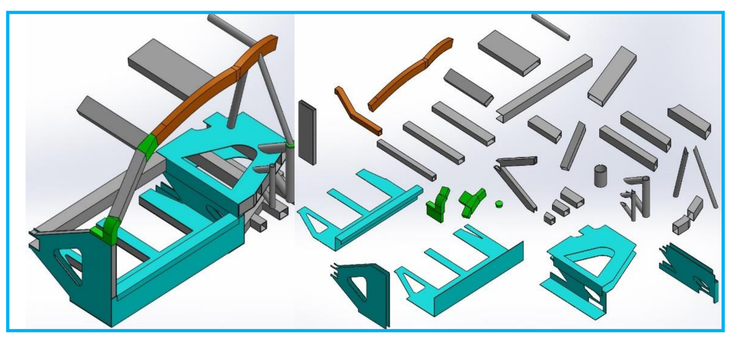
McLaren MP412C – Aluminium
Moderate stiffness & low cost

Porsche 918 – CFC
Very high stiffness & extremely high cost

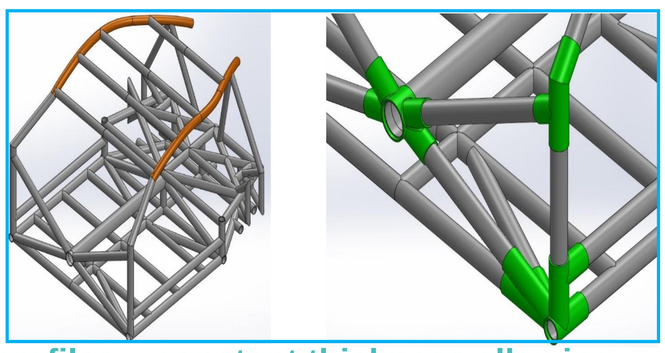
Key Findings

Thermoplastic CFC – Metal Automotive Framework Concepts

Pressed Sheet



Tubular

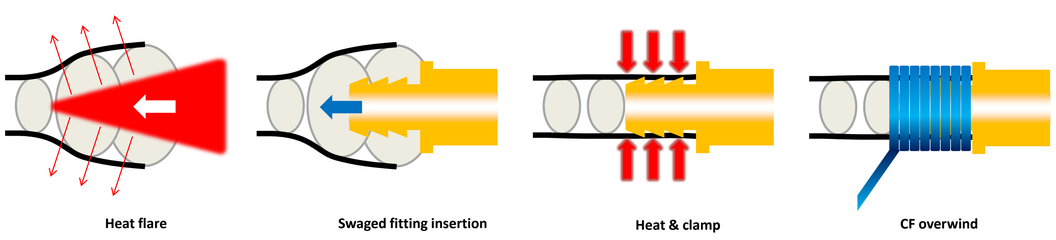


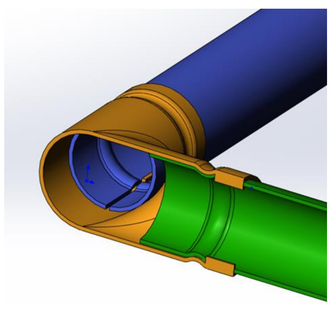
Both can utilise CF TP matrix laminate and profiles – constant thickness allowing continuous manufacturing and localised joint forming

First UK Study using Braided thermoplastic CF Pultrusion

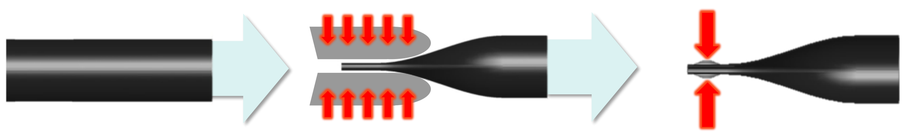
Framework Joining Concepts

A- Swaging - Clinching

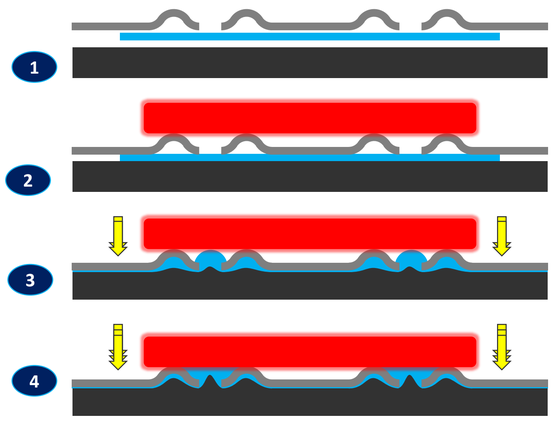


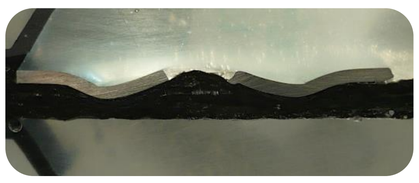


B- Crimping



C - Dimple Interlocking





Conclusions

- **Braided CF tape thermoplastic pultrusion is an attractive process for continuous section manufacture**
- **Three manufacturing concepts for TP CFC structures were proposed and investigated**
  - Wrapping of tubing or open sections around metallic joints or other CFC sections
  - Composite tube swaging or crimping
  - Metal joint interlocking with composite sections
- **The forming process required for swaging is complex due to the need for fibre shearing**
- **Tube crimping is fast and simple and requires simple (low cost) metallic connections**
- **Dimple interlocking concept offers fast, simple forming and strong joints**

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