The Clamshell Project

Mr Kirk Willicombe
Professor Ian Hamerton
Dr Carwyn Ward

BCI Student Showcase
13 April 2021

Kw12738@bristol.ac.uk
bristol.ac.uk/composites
The Problem

Climate Crisis

Lightweighting to Cut Emissions

Unsuitable Manufacturing Methods

Radical Change Required -> Composites

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The Solution: Clamshell

- Rigid exterior shell to protect preform
- New, novel manufacturing process, designed bespoke from start to finish for the high-volume, automotive industry
  - Dry fibre placed into rigid lower shell
  - Top shell closed on top, sealed, so preform held to shape
  - Preform transported to final press station
  - Heated press melts shell and compresses through the fibre, impregnating the material
- Thus, the external shell has:
  - Shaped the preform
  - Protected the preform during transportation
  - Become the matrix for the final part
Benefits

• Targeting the rate issues that prevent composite adoption in automotive
  • Removes binder – large time-cost for current process (~50%)
  • Lowers cost by removing high-pressure injection
  • Gives pathway to £/kg and takt time targets
  • Disruptive technology to revolutionise preforming for high-volume applications

• Sustainability addressed
  • Perfect for recycled fibres, which are normally difficult to hold in shape
  • Reformable shell materials likely mean a matrix that’s easier to recycle

• Transportation shells
  • Cost saving due to vacuum lines being able to be shut off

Evaluation of the time cost of each stage of the fabrication of a simple automotive part manufactured utilising HP RTM
Current Work – Forming and Transport

• 3D shell prototypes vacuum formed to shape

• Transportation with robotic pick-and-place systems
  • Reduced geometric deformation
  • Fewer defects imparted during the transportation process
  • Expensive/complex needle grippers not required
Current Work – Compaction/Infusion

• Heated Compaction Trials:
  • PLA and 6-ply UD carbon
  • Good impregnation possible
  • Process refinement required

[Images showing impregnated and dry surface fibres]
Current and Future Work

- Custom experimental rig
  - Expanded range of testing capabilities
  - Previous results replicated on larger scale
  - Better replication of industrial processes

- Further process refinement

- Expansion of concept utility
  - Recycled fibre preforms
  - Multi-element parts
Thank you!

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