University of BRISTOL

Bristol Composites Institute (ACCIS)

The Clamshell Project

Mr Kirk Willicombe
Professor Ian Hamerton
Dr Carwyn Ward

BCI Student Showcase

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Kw12738@bristol.ac.uk

bristol.ac.uk/composites

accis
ADVANCED COMPOSITES COLLABORATION FOR INNOVATION & SCIENCE

UKRI Engineering and Physical Sciences Research Council

University of BRISTOL

EPSRC Centre for Doctoral Training in Advanced Composites for Innovation and Science

The Problem


Climate Crisis

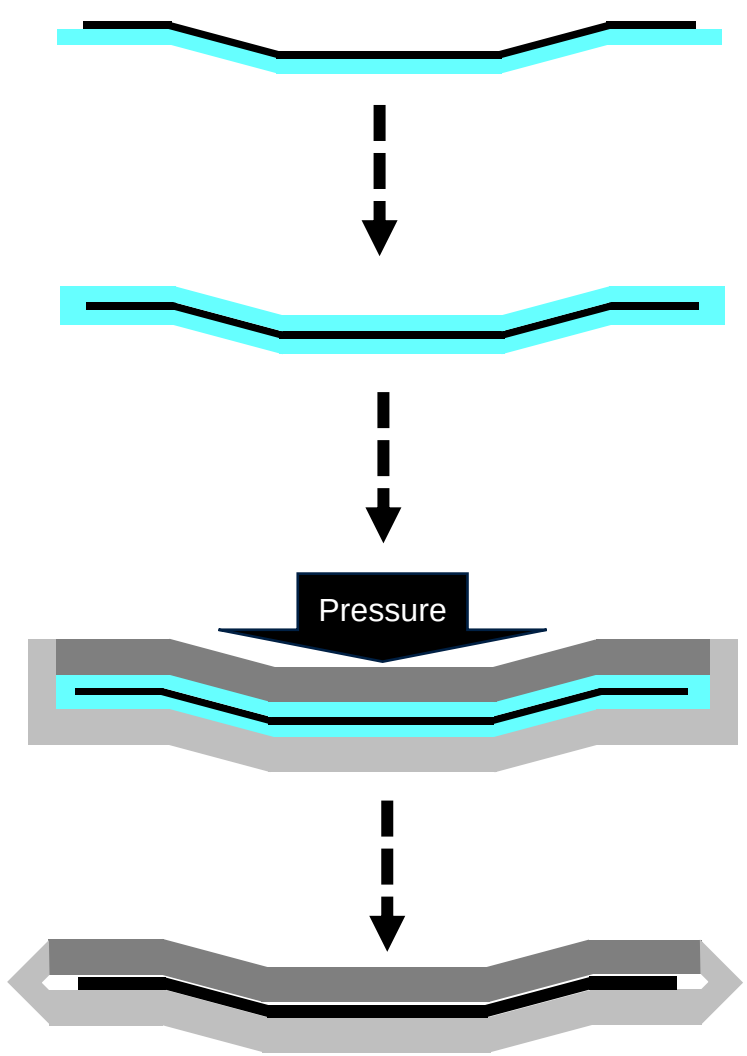

Lightweighting to
Cut Emissions


Langzauner
Unsuitable Manufacturing
Methods


Radical Change
Required -> Composites

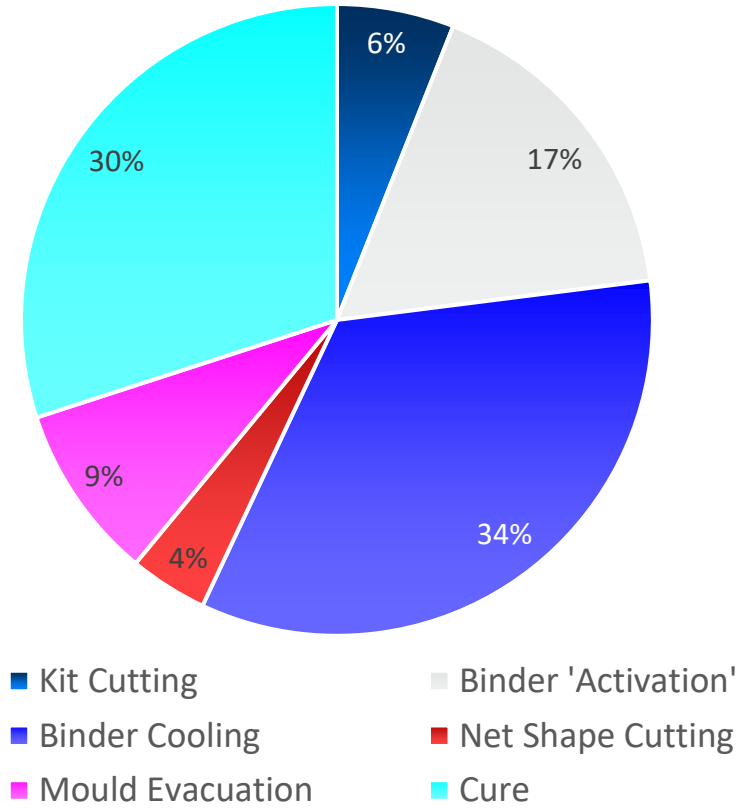
The Solution: Clamshell

- 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

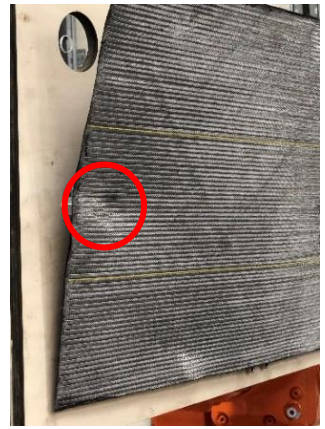


Evaluation of the time cost of each stage of the fabrication of a simple automotive part manufactured utilising HP RTM

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



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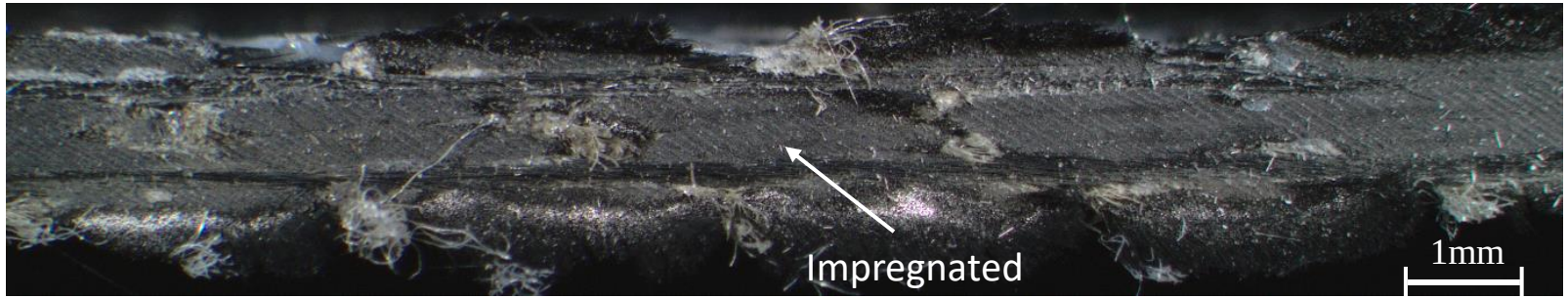
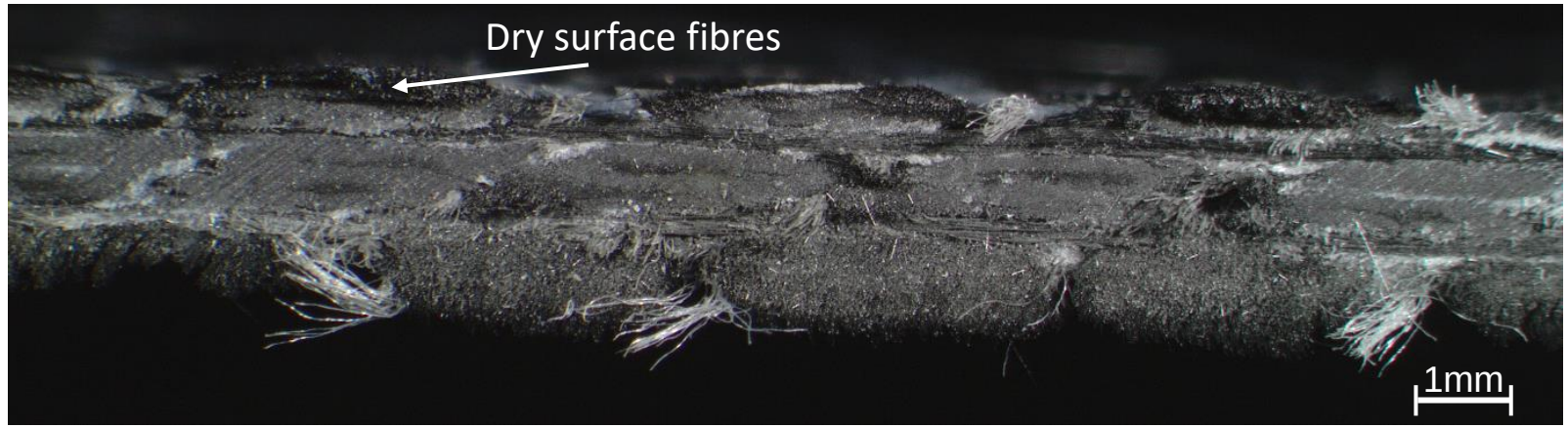
Current Work – Compaction/Infusion

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





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

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Thank you!

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