Market-Led Innovation
Hybrid Moulding

● **Drivers**
  - Manufacture of complex shape parts
  - Reduction in recurring costs
  - Geometrical optimisation
  - Functional integration
  - Improved mechanical performance
  - Improved damage tolerance
  - Ease of processing

● **Approach**
  - Investigate hybrid technology opportunities for complex-shaped structural parts
Current Hybrid Technologies

Overview

● Overmoulding Basics
  • Overmoulding metals is an old technology
  • Overmoulding composites
    • Pre-consolidated laminate – ‘organo-sheet’
    • Melt the matrix
    • Thermoform the laminate
    • Injection mould structures onto the surface

● Challenges
  • Control of fibre orientation during forming
  • Another heat cycle for the laminate matrix
  • Post-moulding operation to remove the excess laminate
  • Uniform laminate thickness

Mount the laminate on a frame

↓

Melt the composite matrix

↓

Position the laminate in the gap between the open mould tool

↓

Close the mould tool and form the laminate to the desired shape

↓

Inject the polymer to form the ribs etc

↓

Cool and eject
Advanced Hybrid Technologies

Overview

- **Ideal Process**
  - Pre-form the composite laminate to the net shape
  - Design the laminate to maximise the performance
  - Necessitates being able to vary the thickness of the laminate
  - Mount the net shape into a mould tool
  - Inject the polymer onto the surface
  - Cool and eject

- **Benefits**
  - Laminate fibre structure does not change
    - No post moulding operations
    - Lower energy requirements = lower costs

- **Challenges**
  - Potential for variations in laminate thickness
Initiating the Bond

Overview

**Bonding**

- Molecular scale bonding requirements
  - Compatibility of the resins/same resin
  - Similar mechanical properties
  - Similar levels of crystallinity

- Resin combinations
  - Moulding PEEK onto a solid PEEK laminate does not work
  - Energy available from the melt is not sufficient to melt the solid surface
New Hybrid Technology
Developed by Victrex

PEEK moulded surface

Good bonding

Composite surface
New Hybrid Technology
Developed by Victrex

● Structural Aerospace Bracket

• Insert made from VICTREX® PAEK-based continuously-reinforced composite
• Injection moulded component made from VICTREX PEEK polymer
• Manufactured by Tri-Mack Plastics Manufacturing Corp.
Potential Applications

Aerospace

Composite front plate

Composite rear plate

Injection moulded fillet

Injection moulded bracket

Injection moulded bracket

Window Frame

Red – VICTREX® PEEK injection moulding polymer

Grey/black – VICTREX PAEK-based continuously-reinforced composite
If you have questions regarding the hybrid moulding technology, please contact...

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