p-CEAMS: The next generation of high performance, quality assured recycled carbon fibre products

Kyle Pender | Advanced Research Engineer

16th November 2023
Composites Critical in Delivering Net Zero 2050

- Demand in **2050 c. x15 in 2030**

- **Sovereign capability** issues with impending 15-60% shortage of CF within 5 years

- 58,000t of virgin carbon fibre is needed by 2030 just for land-based hydrogen storage

To meet UK Net Zero targets and ensure UK energy security we need solutions to establish a UK circular economy for carbon fibres which enable high value routes to market.
Vision for carbon fibre recycling

Commercial available recycled carbon fibre products are short / discontinuous

Relegates recycled carbon fibre reuse in lower value applications with limited ability to replace virgin carbon

Continuous recycled carbon fibre can be reclaimed (e.g. from H₂ pressure vessels)

Analogous format as virgin fibre opens the door to use in established high value reprocessing and reuse cases...Greater potential to replace virgin carbon fibre and increase UK resource and energy security

Value proposition

NCC, Cygnet Texkimp & B&M Longworth
2022 Pressure Vessel Sprint Demonstrator

- Insufficient CF production to meet demand
- Prove out viability of recovering continuous fibre from composite pressure vessels

- Reclaimed using DEECOM process
- Unwound continuous tow from EOL PV
- Demonstrator manufacture
- Showed the art of the possible through collaboration
Like most recycled materials these are different to virgin

If only life was that simple....

rCF mechanical properties on par with widely used industrial grade virgin materials

*Based on limited data we have from 2022 sustainable tank demo – will be further explored in current project
NCC is developing QA technology for rCF tows

£100m
Innovation Accelerators programme (IUK)

£33m
Greater Manchester Innovation Accelerator

£5.5m Grant
Pilots for Centre of Excellence for Advanced Materials Sustainability (p-CEAMS)

£0.92m
NCC, Cygnet + NPL & UoM/Royce

Delivering an innovation ecosystem across the city-region that will help level up communities

Demonstrate the need and develop the business case for a new national R&D asset

Positioning CEAMS with capability to overcome key challenges in confidence of using circular material

Develop and demonstrate capability for quality assuring recycled, continuous carbon fibre from composite pressure vessels

- Continue to develop NCC capability in recycling, quality assurance, inspection, manufacturing
- NCC access to strategically important region and steer direction of CEAMS – compliment NCC capability
- Strengthen relation with research partners and support SMEs in region
**p-CEAMS enabling and demonstrating high value reuse of rCF**

- **Waste CFRP feedstock**
- **Waste reclamation, unwinding, re-winding**
- **Reclaimed continuous tows**
- **Reformatting and remanufacture trials**
- **Continuous reclaimed tow demonstrators**

**DELIVERABLES**

- Optimise continuous tow recycling
- Develop inline tow inspection capability
- Develop quality assurance testing capability
- Internal and supply chain manufacturing demos

**ADDITIONAL COLLABORATIONS**

- Identify uses / post processing requirements for polymer recyclates
- Identify, trial, demo post processing treatments for fibre surface reactivation / functionalisation
- Characterise “functional” properties of recycled CFs for multi-functional materials

Provide industry with the confidence needed to use recycled CF tows in high value applications.
Trials have already kicked off with great success

Pipeline trials / demos:
- TP filament 3D printing
- TS filament 3D printing
- Prepreg / towpreg
- Pultrusion
- AFP/ATL
Let's collaborate!!!

ONE DOES NOT SIMPLY MAKE THE DREAM WORK

WITHOUT THE TEAMWORK