

# MODELLING OF RECYCLED CARBON FIBRE-REINFORCED 3D-PRINTED THERMOPLASTIC COMPOSITES



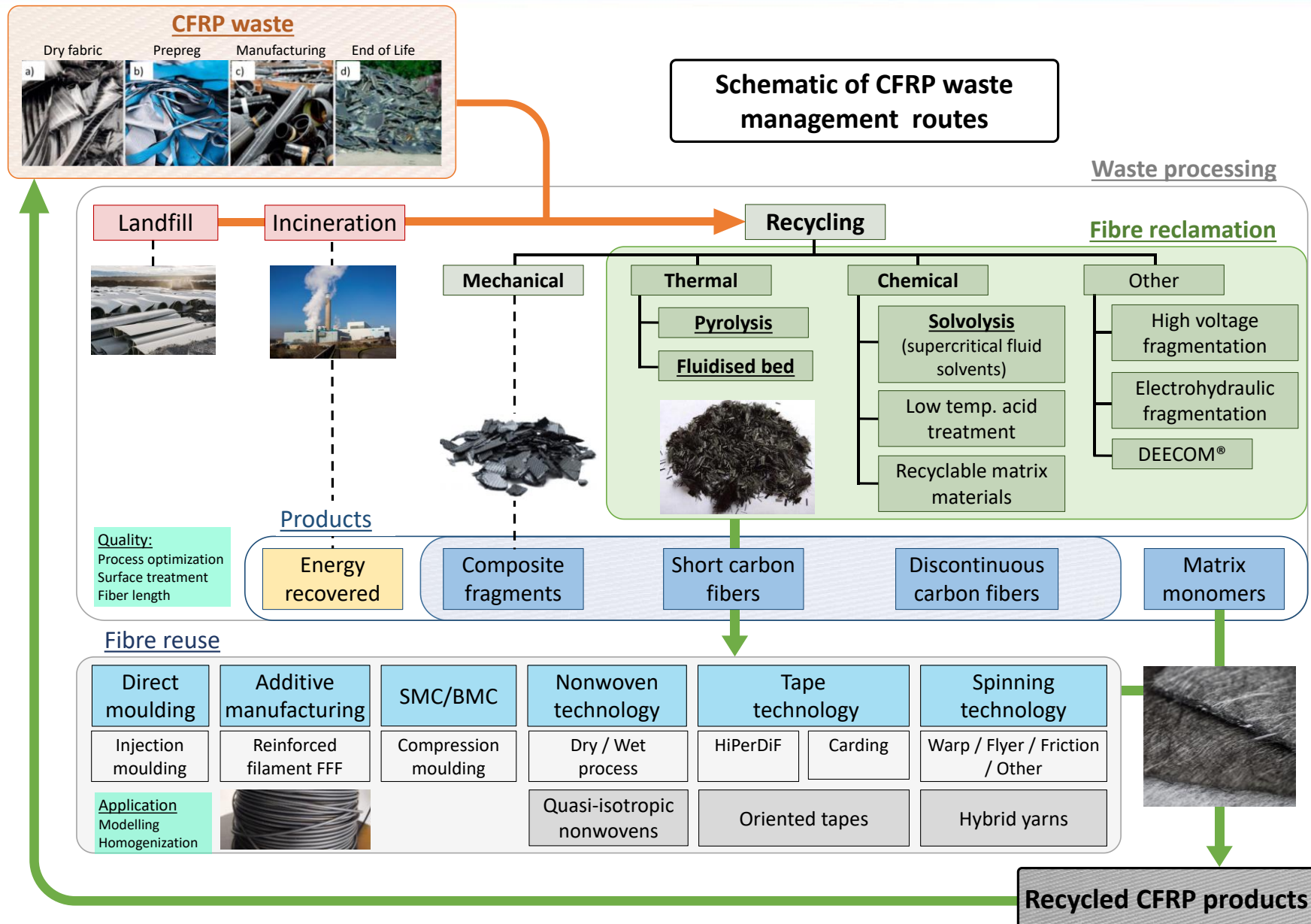
**Péter Sántha**  
PhD student  
santhap@pt.bme.hu



Supervisor:  
*Dr. Péter Tamás-Bényei*  
Assistant professor

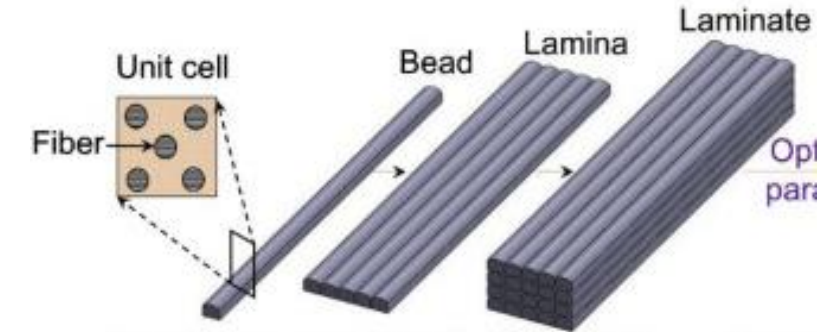
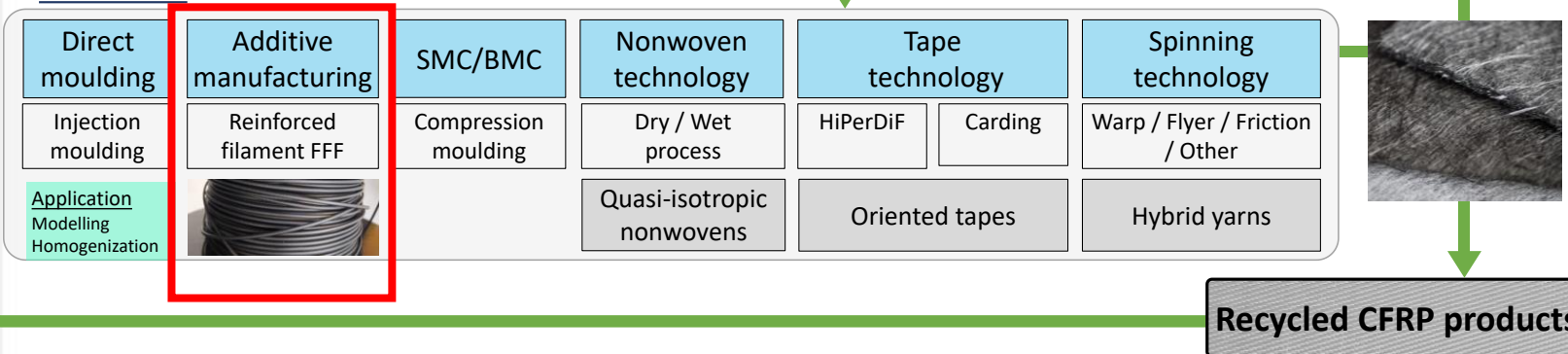
International Conference on Composite Materials 2023  
Queen's University Belfast  
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# CARBON FIBRE RECYCLING PATHWAYS



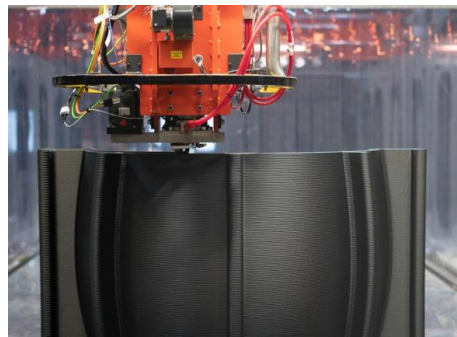


## Fibre reuse



Papon, E. A. et al. Process optimization and stochastic modeling of void contents and mechanical properties in additively manufactured composites. Composites Part B: Engineering, 107325. (2019)

## Additive manufacturing in composite tooling



<https://airtech3d.com/print-tech>

## Functional prototypes, Low-volume manufacturing



<https://www.9tlabs.com/case-studies/helicopter-door-hinge>

## Modelling



## Properties:

### Bead level uncertainty

(fibre length, orientation, volume fraction, fibre and matrix modulus, interfacial shear, void content)

### Lamina level uncertainty

(lamina modulus, bead diffusion length, void content, elastic constants, thermal conductivity)

### FFF process variables

(temperature, print speed, nozzle diameter)

## Physical model:

- MROM
- Void model
- Homogenization
- CLT

## DETERMINATION OF MODEL INPUTS

## Filament production:

- Teluran GP35 ABS + vCF/rCF 10; 20 m/m%
- Twin screw extruder (Labtech - LTE 26-44)
- Filament diameter:  $\varnothing$  1,75 mm

## Speciment production:

- Table temperature: 90-110°C
- Nozzle temperature: 220-250°C
- 0-90° layers, 100% infill

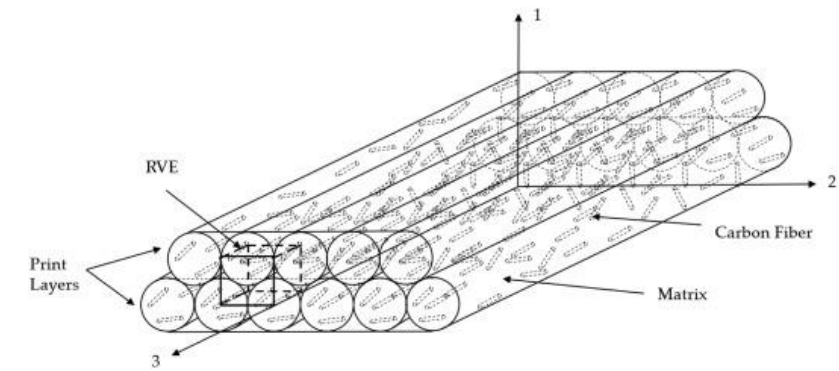


## Characterisation:

- Tensile testing
- Fibre content
- Residual fibre length
- Fibre orientation – ellipsometry

## Parameters:

FLD, FOD,  $E_{11}$ ,  $E_{22}$ ,  $\nu_{12}$ ,  $G_{12}$ , UTS



Adeniran O. et al. Material design factors in the additive manufacturing of Carbon Fiber Reinforced Plastic Composites: A state-of-the-art review, Advances in Industrial and Manufacturing Engineering, 100100. (2022)



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**P010**

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Thank you for your attention!

