



MATERIAL CHARACTERISATION OF LARGE DIAMETER THROUGH THICKNESS REINFORCING PINS IN COMPOSITES

MR VINODHEN SAARAN

BACKGROUND

- Existing **Through-Thickness Reinforcements (TTR)** methods for laminated composites present size limitations towards applications, hence a novel insertion method was introduced compromising of large **diameter pins (>1.0mm)**
- Integration of **photonic sensors** into composite tooling for various applications **not viable** due to **size limitations**
- This project analyses the **material characteristics** post insertion to understand its material performance and fracture mechanics

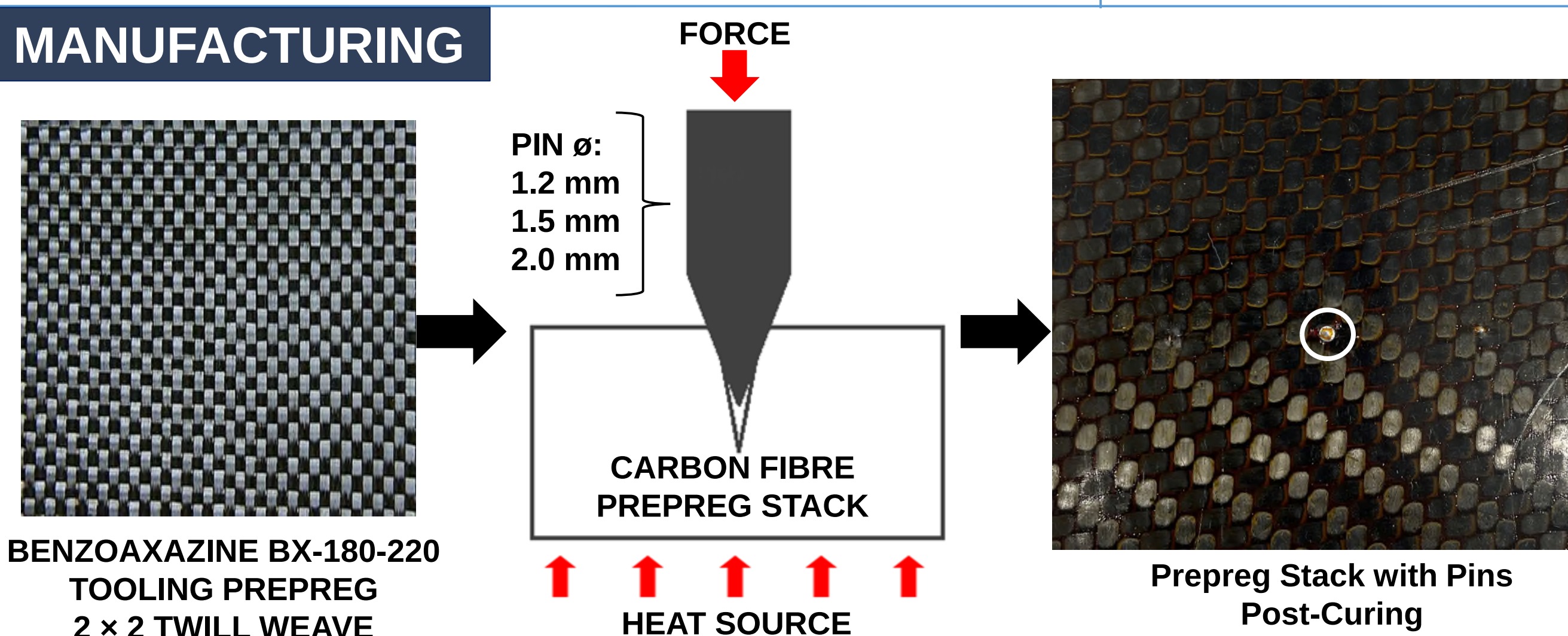
AIM

To **characterise** the behaviour of TTR large diameter pins in composites under loading conditions, **analyse** the **fracture mechanics**, **in-plane** and **out-plane** properties experienced

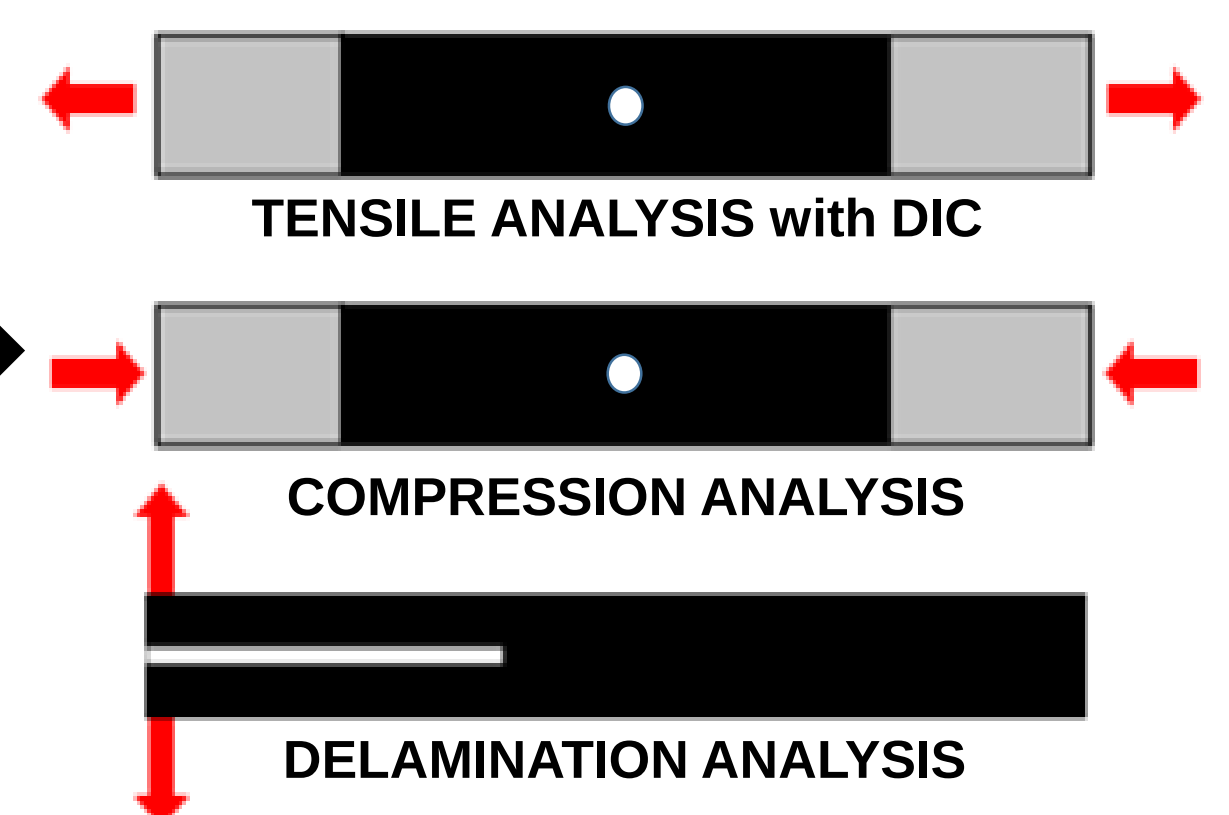
OBJECTIVES

- Experimental evaluation on material performance** of composite with large diameter TTR pins
- Analyse fracture mechanics**, **in-plane** and **out-plane** properties
- Define a **relationship model** between various **pin diameters** and the **material performance** of composites with TTR pins

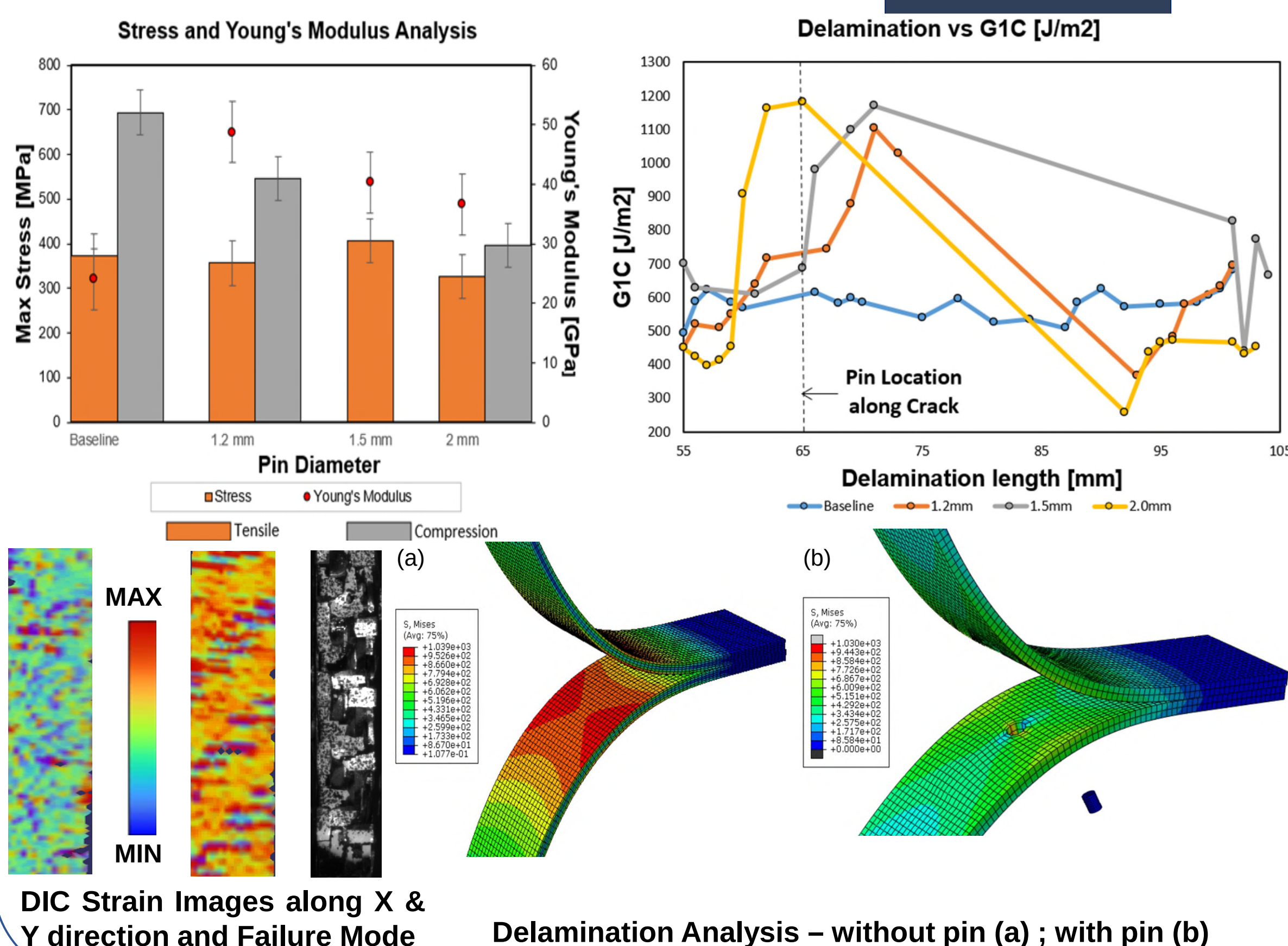
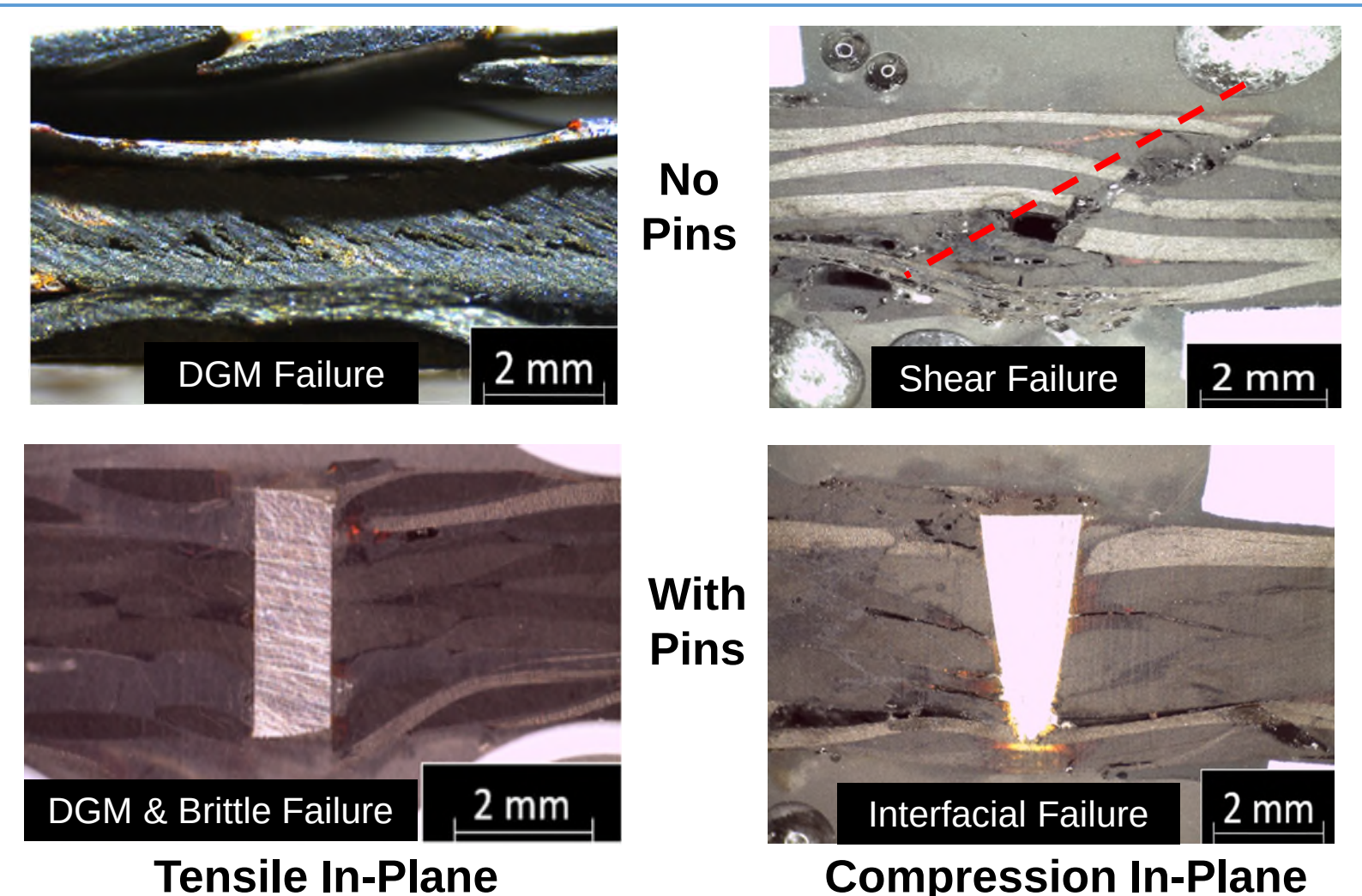
MANUFACTURING



MECHANICAL TESTING



RESULTS



CONCLUSION & FUTURE WORK

- Pin ϕ has **effect** on composite **mechanical & plane** properties
- Pin $\phi = f_y$; $\propto \frac{1}{f_c / \epsilon_{ys} / \epsilon_{yc}}$; $\propto G_{1c}$**
- In-plane properties & Failure mode altered with pin presence
- Further **mesoscale analysis** on TTR pinned composite micro mechanics will be beneficial

Dr Geoffrey Neale

g.d.neale@cranfield.ac.uk

Building 56, Cranfield University, Building 56, Cranfield University,
MK430AL Cranfield.

www.cranfield.ac.uk

2022

Dr Alex Skordos

a.a.skordos@cranfield.ac.uk

Building 56, Cranfield University, Building 56, Cranfield University,
MK430AL Cranfield.



Partially funded by the European Union's Horizon 2020 innovation programme under grant agreement No. 871875