Realising the Potential of Carbon Fibre Composites in Compression

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Outline

Introduction – Material Properties:
• Carbon Non-linearity
• Carbon Fibre – Theoretical Limits

Compressive Failure:
• Carbon Composites – Failure
• Parameters Affecting Failure

Future Work

Acknowledgements
Carbon Non-linearity

- Non-linearity in carbon well-documented
- Modulus drops as compressive strain increases

Source: [1]

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Carbon Fibre – Theoretical Limits

- Single fibre response shows high strain
- Metallic-like plateau

![Single Fibre Compressive Test](image)

Source: [2]

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Compressive Failure of Composites

- Failure not due to fibre limit
- Structural phenomenon – shear instability

- Compressed composite subject to shear stress
- Resulting shear deformation increases misalignment
- Shear increases until reaching equilibrium
- Loss of equilibrium at high enough stress causes failure

Source: [3]
Parameters Affecting Failure

- Matrix properties govern the strength
- Higher initial misalignment lowers the strength

Shear Stress [MPa] vs. Shear Strain

Maximum strength [MPa] vs. Initial Misalignment [°]

- G = 1 GPa
- G = 2 GPa
- G = 4 GPa

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Future Work

Create a test to:

- Compress carbon/epoxy composite to high strains
- Measure non-linearity
- Validate models

Explore new materials
References:

