University of BRISTOL

Towards ductile CNTF/polymer composites

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20/1/2014

Supervisors:

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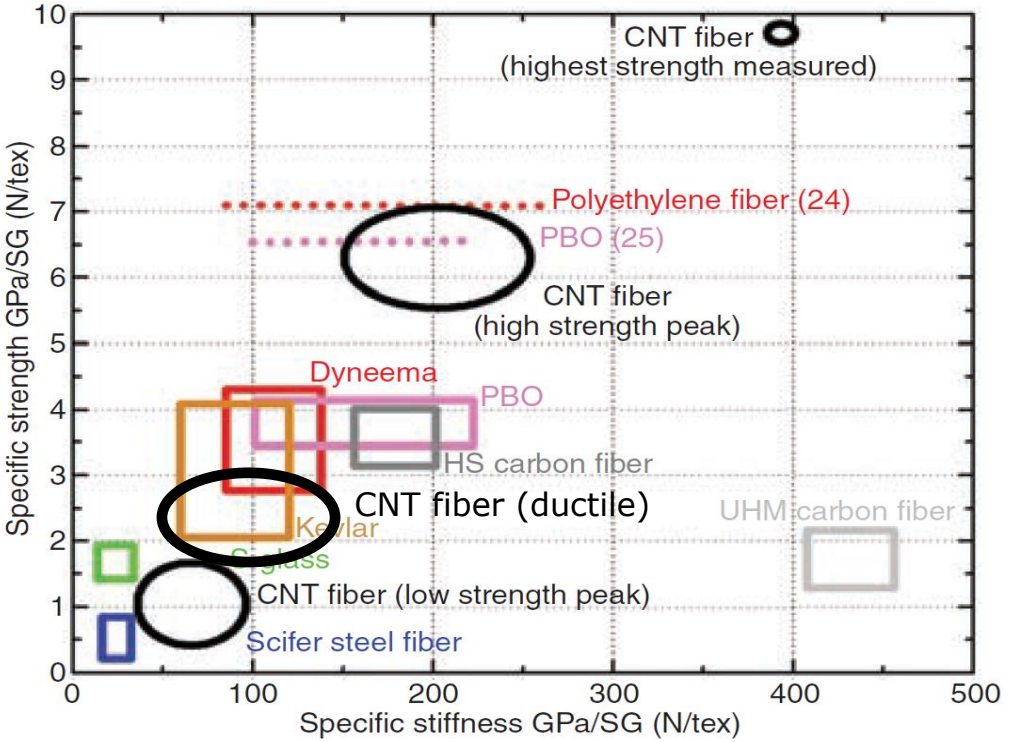
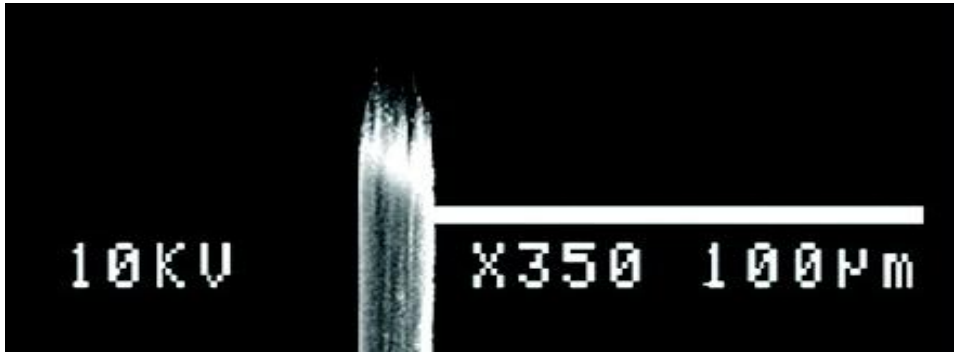
CNT Fibres - Background

A Cutting Edge Reinforcement

- Aligned bundles of CNT
- Good specific strength, stiffness
- Ductile, $\varepsilon^* = 5 - 7\%$
- Electrically conductive
- Simple, continuous processing
- **Potential to reinforce polymer composites**



Koziol et al., Science, 2007



Boncel et al., ACS Nano, 2012

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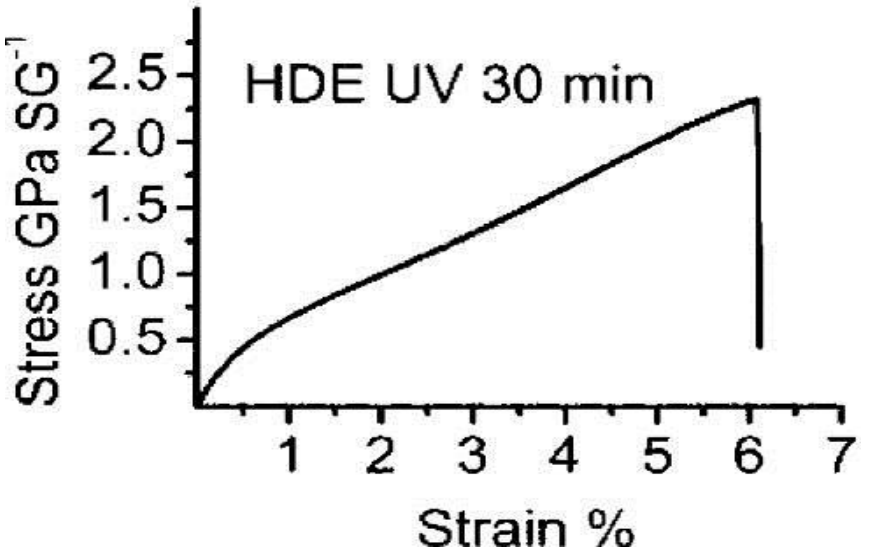

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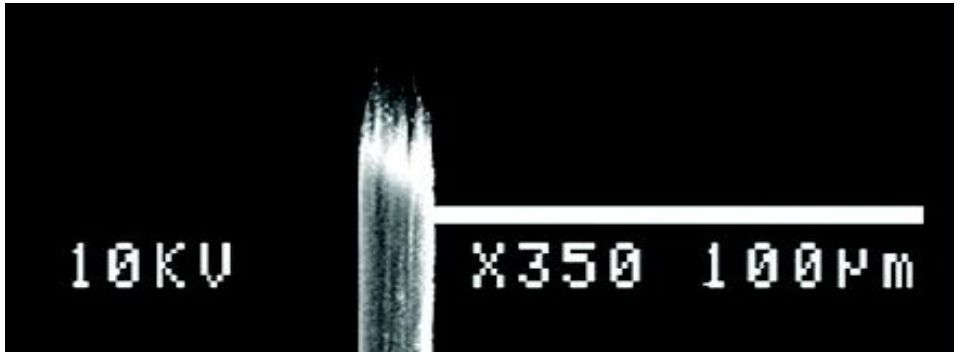

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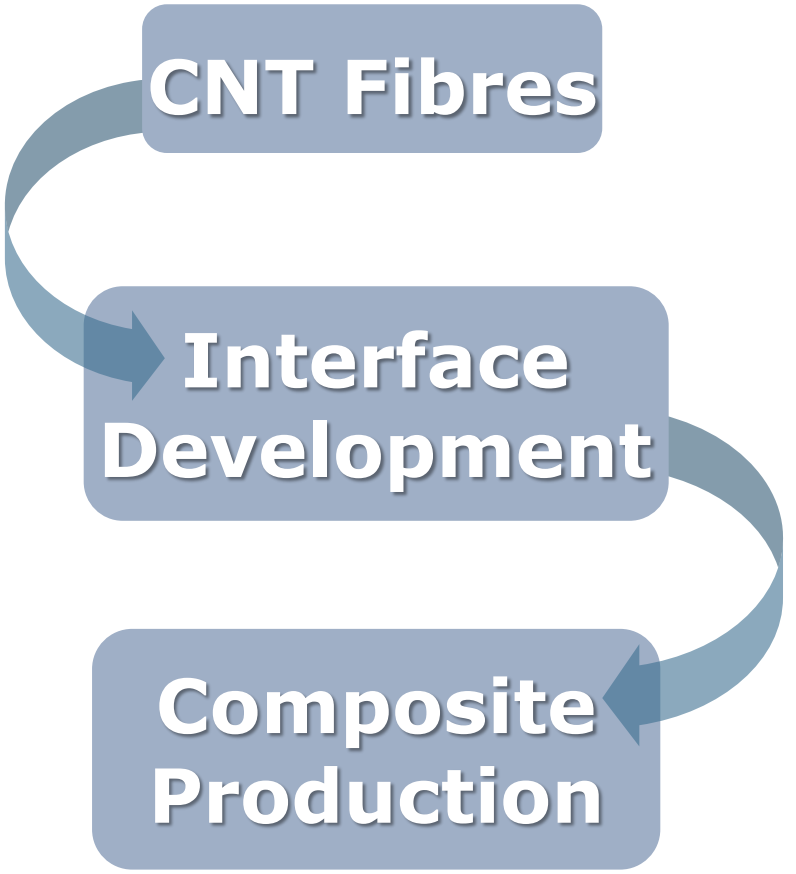

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Development - Interface

Problem:

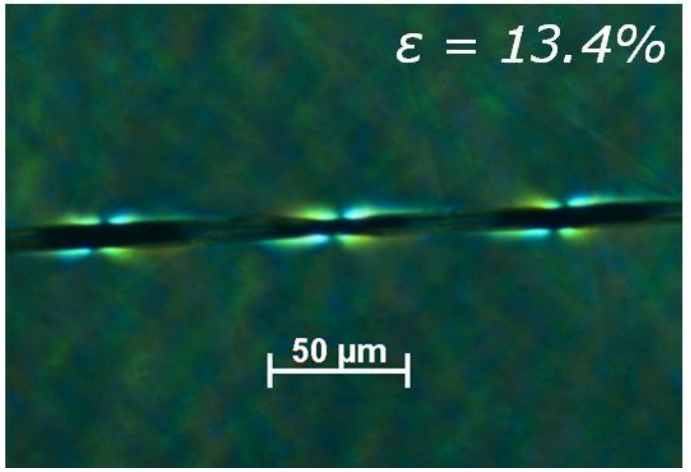
- CNTF surface:
  - Porous
  - Low surface energy
  - Chemically unreactive

Solution:

- Infiltrate fibre with matrix

Results:

- τ_{IFSS} = 51 MPa
- 50% fibre strength improvement
- Adhesion beyond 10% strain
- "Prepreg fibres"



Ready to make composites

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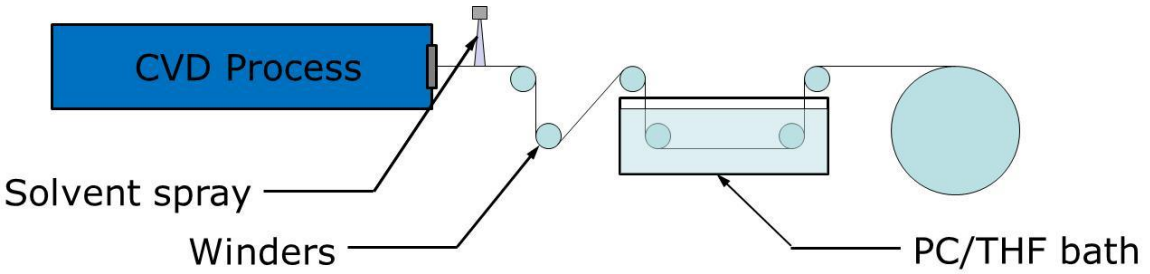
Next Steps

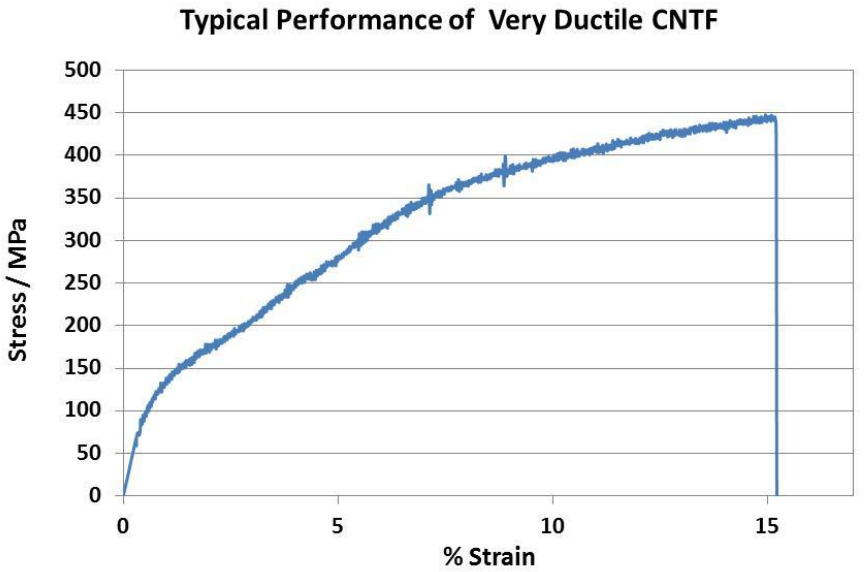
Composite Development

- Fibres infiltrated with matrix
- "Prepreg fibres"
- Very high V_f
- Single process



Fibre Development

- Working on increasing ductility
- Strains to failure >15% achieved



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Summary

- CNTF have great potential:
  - Ductility
  - Multi-functionality
  - Simple, continuous production
- Developmental difficulties of interface and introducing matrix overcome
- Hopefully (small!) ductile composite demonstrators will follow soon

Acknowledgements:

HiPerDuCT
Programme Grant

THE BRISTOL CENTRE FOR NANOSCIENCE AND QUANTUM INFORMATION

UNIVERSITY OF CAMBRIDGE

EPSRC
Engineering and Physical Sciences Research Council

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