

# Failure Analysis of Polymers and Composites

QinetiQ offers a comprehensive facility for the fractographic assessment and failure analysis of composite materials and structures including:

- Post-mortem analysis of failed components
- Identification of failure mechanisms
- Characterisation of anomalous test results
- Validation of predictive models using experimental tests
- Modelling of physically based failure criteria

Advice is also given on:

- Manufacturing and design optimisation
- Validation of component design

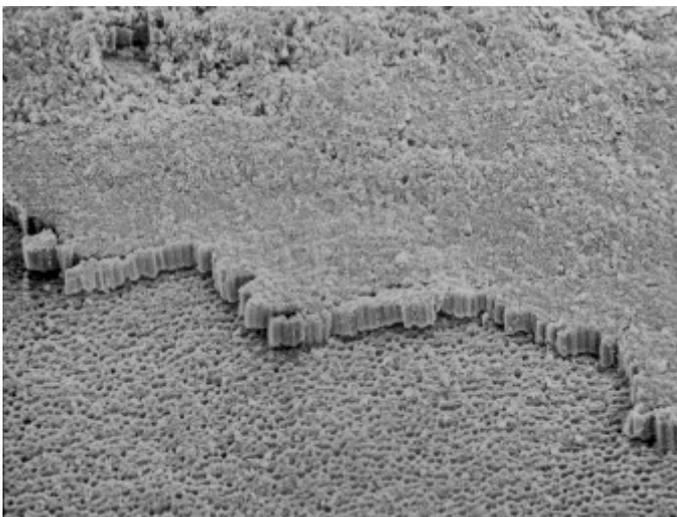
A team of specialists can analyse complex failures in composite structures arising from laboratory tests and the in-service environment. The team can assess and identify failure initiation, fracture directions and sequences. Failure analysis is an integral part of QinetiQ's research programmes and has led to improvements in design and manufacture of structures .

## Capabilities

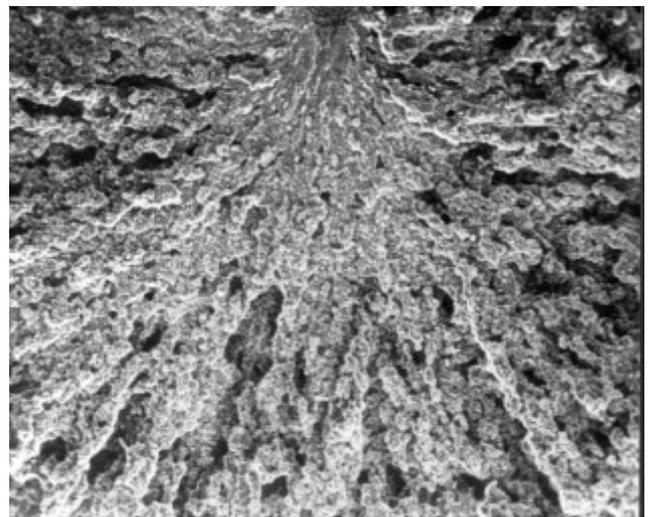
A range of techniques are available for the investigation of composite failures:

- Ultrasonic inspection
- X-ray radiography
- Chemical analysis
- Polishing/sectioning facilities

Solutions can be offered to improve manufacturing and component design including validation using modelling and testing .



Compression failure



Tension failure

## Types of failure

QinetiQ is experienced in a range of failure analysis for polymers and composites , including:

- Impact damage
- Ballistic & soft-body impact
- Energy absorbent & crashworthy structures
- Delamination induced failures
- Environmental & fire damage
- Lightning strike damage
- Dynamic and fatigue loading
- Notches/bolted failures
- Bolted and bonded joints

## Materials & architectures

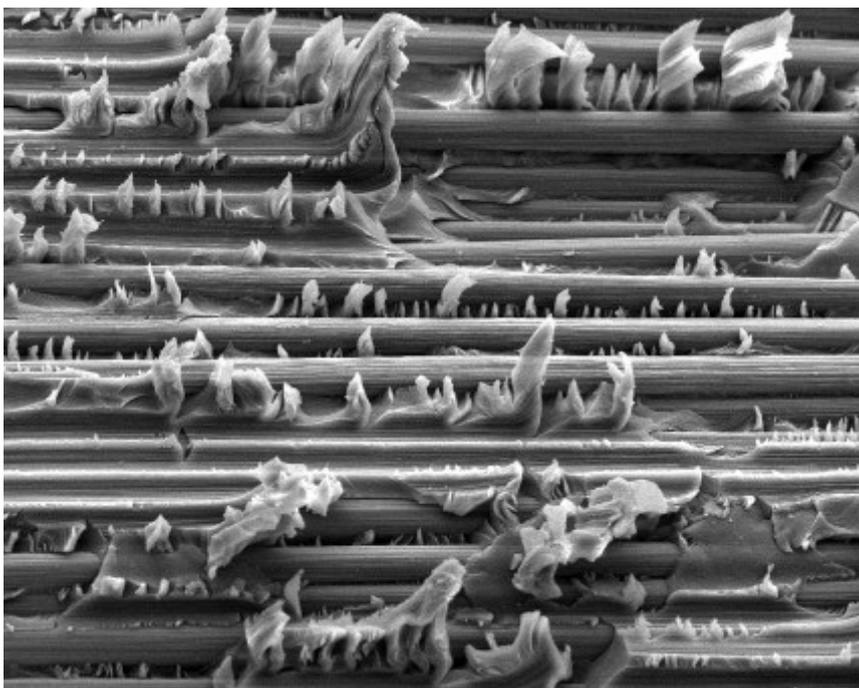
Our expertise covers a range of polymeric composite materials including:

- Prepreg laminates
- Carbon/Glass/Aramid fibre
- Continuous fibre composite
- Short-fibre composite
- Woven, braided & 3D materials
- Resin infusion & impregnation
- Filament wound
- Wet lay-up
- Thermoplastic matrices
- Thermosetting matrices
- Stitching and tufting
- Optical microscopy
- Electron microscopy/elemental analysis

## Training

QinetiQ can offer tailored training to scientists and engineers in the failure analysis of composites. Courses up to five days, which include lectures and practical sessions with comprehensive notes and background literature can be arranged.

The fracture modes and analysis procedures are explained, and then representative surfaces are examined using optical and electron microscopy.



Shear fracture of a brittle composite

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