

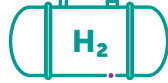


PETRONAS

# ProTough+

An Advanced Materials Solution

Unlocking the power of graphene, specially formulated for the composites industry



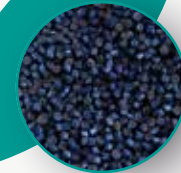
Enhance the properties of polymer composites with our cutting-edge formulated graphene additive and proprietary dispersion methods. Elevate your materials to new levels of performance and durability



Fibre-reinforced polymers

Improvements in mechanical properties, especially in matrix-dominated properties

Thermoplastics



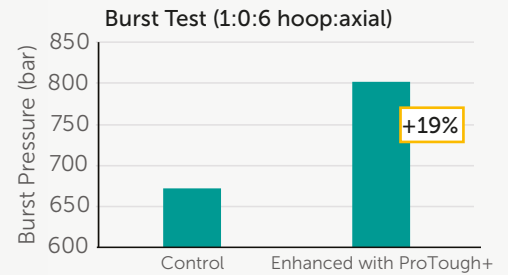
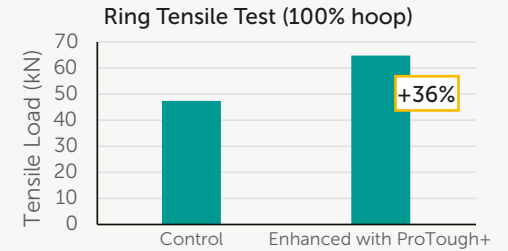
ProTough+, a comprehensive solution for the composites industry:

1. Available in **concentrated masterbatch** form for smooth integration into existing production lines
2. **Customisable** to your specific composite system for consistent and optimal performance
3. Produced from petroleum coke using **70% less energy** than typical graphitisation process

## Filament-wound tubes and cylinders

Value Proposition

- Higher storage capacity
- Lighter cylinders with lesser materials used



Toray T700 carbon fibre tube with epoxy resin, epoxy resin



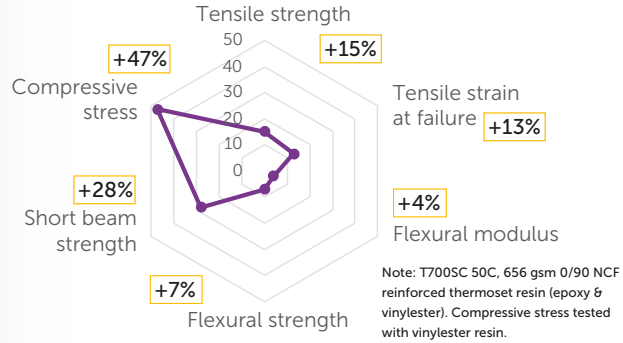
# FRP panels

## – Carbon and Glass

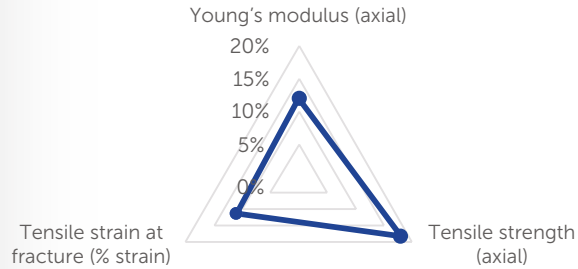
### Value Proposition

- Stronger and more durable parts
- Lighter parts with less materials used

### Performance gain with ProTough+ on Carbon Fibre (%)



### Performance gain with ProTough+ on Glass Fibre (%)



- +29%** Creep reinforcement efficiency
- 132x** Longer Creep life improvement at 28°C

Note: Volume fraction of ~40% (E-glass). At lower wt%, fatigue life improvement at 90°C observed up to 30 times longer.

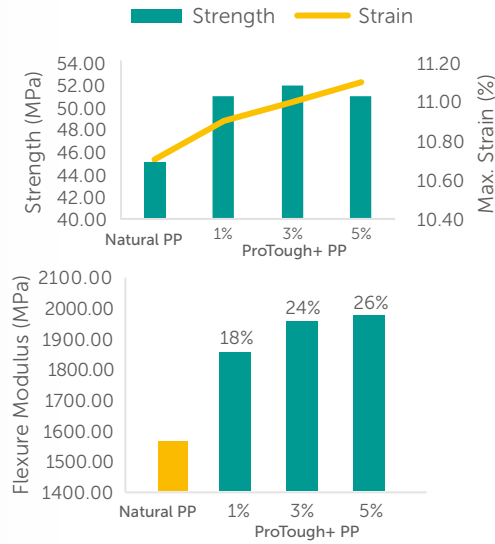


# Thermoplastics

### Value Proposition

- Stronger parts
- Lighter parts with less materials used

### Flexural Properties Improvement



### Tensile Properties Improvement



**PETRONAS Advanced Materials** has been trusted by many organisations to generate value through pioneering innovation and close collaboration.

We are committed to delivering the best results and invested in your ultimate success.

## Contact Us

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