Trinity College Dublin

2-D Materials for Polymer Fibre Reinforcement

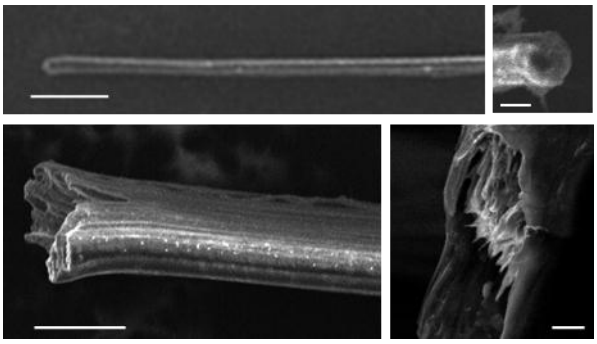
Available for Licence

Basic overview

Researchers at CRANN, Trinity College Dublin, have discovered a method of **adding exfoliated nanotubes or graphene** to polyester and subsequently preparing fibres from the mixture. Even at nanotube or graphene contents of ~1%, the **strength and stiffness of polyester-based fibres can be increased by a factor of ×2 to ×4**. Our best fibres have modulus and strength of 42 GPa and 1.2 GPa respectively, **comparable to the best polyester fibres ever produced**.

Polymer fibres are commonly used in many applications e.g. in textiles, packaging and medical technology industries, due to their high strength, low density, durability, abrasion resistance, and chemical and environment stability. One of the most important polymers used in this area is polyester. A significant property of polyester is its relatively high strength. Increasing this strength would **improve this material and increase the range of applications** where it may be used.

Another major advantage of polyester fibres is their ability to be melt-spun, cheaply and in large quantities. Thus, there would be significant advantages to modifying existing polyesters to produce fibres with enhanced mechanical properties using this pre-existing manufacturing technique to **generate fibres with significantly higher stiffness and strength at a reduced cost**.

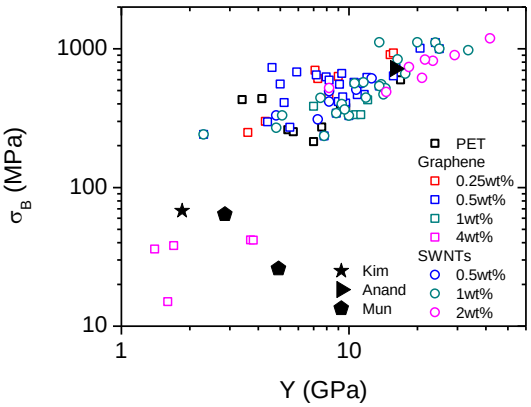


SEM images of melt processed PET-SWNT fibres. The scale bars are A) 20 µm, B) 2 µm, C) 10 µm and D) 1 µm.

Advantages

This technology is a cheap and robust method of significantly increasing the strength of polyester, entering the realm of high performance fibres.

- Method is compatible with existing melt processing techniques
- Cost effective, strong polyester fibres- adding 0.5wt% graphene to a PET fibre is <0.03 c per km for a fibre with a diameter of 100 µm
- Values of modulus and strength are competitive with the best polyester fibres reported to date (PET-nanotube (2wt%) and PET-graphene (0.5wt%) composites show maximum moduli of 42 GPa and 21 GPa respectively and maximum strengths of 1.2 GPa and 1.0 GPa respectively)
- Key to these improvements is largely because due to extremely good dispersion of the filler material in the matrix
- Graphene is expected to become much cheaper to produce than nanotubes



Summary of strength and stiffness data for a variety of fibre compositions. For comparison, the best data from three papers in the literature are also included.

Applications

- Food, drink, pharmaceutical packaging
- Automotive parts
- Recycled PET products- adding graphene could boost strength after recycling
- Clothing fabrics
- Furniture
- Sheets and films

Technology and patent status

The key part of this technology involves exfoliating nanotubes and graphene in a solvent. This dispersion of exfoliated nanotubes/graphene is then mixed with melted polyester. This ensures that the filler is well dispersed in the polymer and is the key to good reinforcement. A priority patent application was filed in 2012.

The opportunity

This technology is available for license. We are also interested in working with a development partner.

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www.crann.tcd.ie/Industry-Commercialisation/Available-Technologies.aspx

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