

# Outsole Innovation

**F**or the dedicated athlete, wearing comfortable and durable footwear is of prime importance. Even weekend warriors, expect their athletic shoes to be long lasting. To meet these challenges, the key is in the design of the shoe's outsole.

However, the outsole is usually the first part of the shoe to wear out.

Research at the University of Manchester in England is advancing the durability of athletic footwear outsoles by developing innovative high-performance rubbers, elastomers, and other soft materials by incorporating graphene. Graphene is a natural form of carbon material that possesses outstanding strength and durability properties.

## The Graphene Material

The Nano-functional Materials Group at the University of Manchester, headed by Dr. Aravind Vijayaraghavan, has been working on graphene-enhanced elastomer materials since 2014. In 2016, the university's research group was approached by Inov-8, a UK-based manufacturer of all-terrain footwear, apparel, and equipment brands, looking to harness and advance the durability of rubber outsoles using graphene.

"The graphene material is incorporated into the rubber through compounding processes to achieve a homogenous dispersion of graphene and rubber," explains Dr. Vijayaraghavan. "The addition of graphene improves the strength and durability of rubber significantly. The graphene-enhanced rubber can flex and grip to all surfaces more effectively without wearing down quickly. This is a revolutionary consumer product that will have a huge

impact on the sports footwear market."

The inov-8 TerraUltra G 260 graphene-enhanced shoes significantly improved traditional rubber outsoles by 50 percent in strength, 50 percent in elasticity, and were 50 percent more durable. While Dr. Vijayaraghavan declined to disclose specific proprietary information about the compounding process or the type and amount of graphene used, he did

say, "We have tested the rubber in tensile testing, tear testing, and abrasion testing, as well as wear-testing the whole shoe in challenging terrains."

Designed for running long distances on hard-packed trails, the TerraUltra G 260 athletic shoe features graphene-enhanced rubber on the outsole and super-tough Kevlar on the upper. The footwear also utilizes inov-8's next-generation underfoot technology, creating the perfect balance between comfort and responsiveness. Weighing just 260g (.57 lbs.), the TerraUltra G 260 has been biomechanically designed to enable the natural movement of the foot.

## Goals for Graphene-Enhanced Material

The University has spun out a new company, Grafine Ltd., in order to achieve future advances for its graphene-enhanced rubber developments.

"We see future applications in a wide range of fields such as automotive, aerospace, medical devices, sportswear, sporting goods, industrial, etc.," notes Vijayaraghavan. "Graphene has proven to be a revolutionary new filler material for the enhancement of rubber and other elastomers. We believe the addition of graphene to elastomers can transform the properties and performance in a wide range of applications. Graphene will bring about significant improvement in strength and durability, increasing the operational life, and at the same time reduce the environmental impact." ●

**Kathlyn Swantko**, president of the FabricLink Network, created TheTechnicalCenter.com for industry networking and marketing of specialty textiles, and FabricLink.com for consumer education involving everything fabric.



**Dr. Aravind Vijayaraghavan, at the University of Manchester's National Graphene Institute, displaying the TerraUltra G 260 shoe with graphene-enhanced rubber outsole.**

For more information on the U. of Manchester's research on "The World's First Ever Graphene Sport Shoes," contact Dr. Aravind Vijayaraghavan, head of the Nano-functional Materials Group at the University of Manchester, at: aravind@manchester.ac.uk, 011 +44(0)161-306-4114.

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