

# Hexotene

## A Unique Proposition for Industry

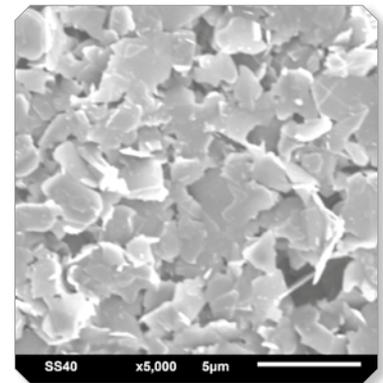
“The introduction of boron nitride into our stable of 2D materials widens the focus of delivering innovative solutions for industry”

Neill Ricketts, CEO

### Our latest 2D success story

Hexotene is a few-layer hexagonal boron nitride (h-BN) nanoplatelet powder with large lateral dimensions. With high chemical purity and mono-layer particles confirmed, Hexotene is the latest addition to our high performance 2D product range.

It's unique characteristics, specifically with regards to electrical conductivity, show some markedly different properties when compared to graphene. This is particularly promising for combined projects using both graphene and boron nitride.



Example BN Nano platelets

### Information

Property	Measurement	Method
Layers	Predominantly few-layer with some mono-layer and bi-layer	Raman spectroscopy
Lateral dimensions	up to 5.0 µm	SEM

Boron	42 ± 2.0At.%
Nitrogen	45 ± 2.0At.%
Oxygen	3.0 ± 1.0At.%
Carbon	8.0 ± 2.0At.%
Method	XPS

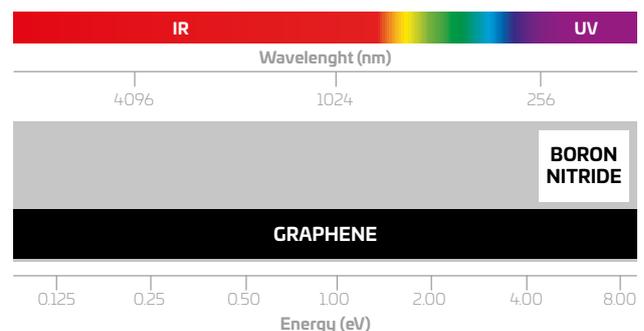
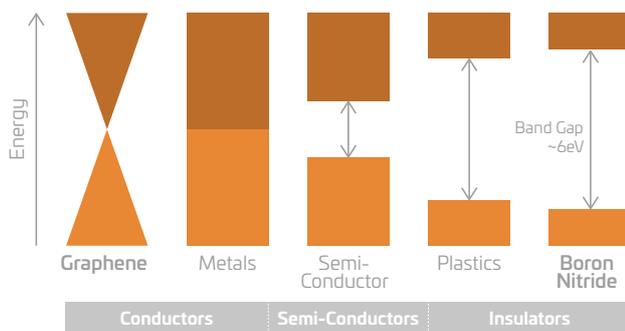


Diagram showing extremes of electrical conductivity, with boron nitride having an ultra-wide bandgap.

Hexagonal boron nitride is white in colour and is unusual as it absorbs high energy UV light, whereas graphene absorbs all light frequencies.

## What is h-BN?

Boron and nitrogen are neighbours of carbon in the Periodic Table. Just as carbon can exist as graphite (hexagonal) or diamond (cubic), boron nitride has both cubic and hexagonal forms and can be produced as nanotubes with a similar structure to carbon nanotubes.

boron nitride (h-BN). It also happens to be the softest of the BN polymorphs.

Also known as white graphene, hexagonal boron nitride has a layered structure similar to graphite.

See below for key properties, as measured in pristine mono-layer hexagonal boron nitride:

The most stable form of boron nitride is hexagonal

### Thermal Stability



Stable to decomposition at high temperatures

### Thermal Conductivity



Typically 1700-2000 W/(m•K)

### Electrical Conductivity



Wide bandgap (~6 eV) Dielectric/ Electrical Insulator

### Light Absorption



Absorbs very high energy UV light

### Chemical Stability



Resistant to many chemicals & solvents

### Mechanical Strength

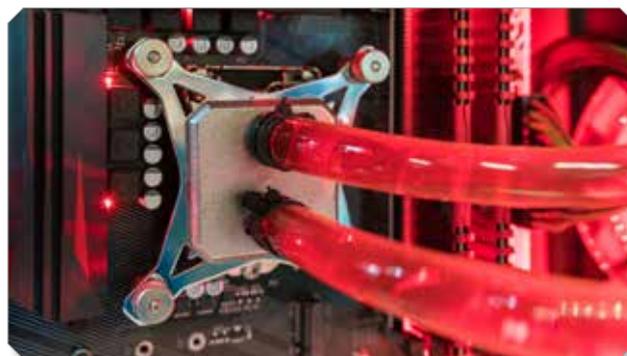


Although soft h-BN's Young's Modulus ≈ 1TPa

## Potential Applications

The lamellar structure of h-BN offers exceptional benefits as an additive in lubricants, and the high thermal conductivity and electrically insulating properties have promoted its use as a high performance additive for specialist lubricants, particularly where heat removal and electrical insulation are paramount.

- ⊕ A good lubricant - at high and low temperatures (up to 900 °C) and in a vacuum.
- ⊕ h-BN can be included in ceramics, alloys, resins, plastics and rubbers to improve insulating ability.
- ⊕ Electronics, oxygen sensors, xerographic processes and laser printing.
- ⊕ Proton conductors, fuel cells, water electrolysis.
- ⊕ Thermofluids and thermal management.



As a highly effective electrical insulator, h-BN potentially has a significant role to play in high performance electronics.

## Versarien<sup>®</sup> Tomorrow's Materials Available Today

Versarien<sup>®</sup> PLC is at the cutting edge of 2D material development. Founded in 2010, Versarien<sup>®</sup> is a specialist materials producer that delivers engineering advantage through innovation to a broad variety of industry sectors. With over 100 staff in five different locations across the United Kingdom, Versarien<sup>®</sup> is leading 2D materials development and manufacturing, with patented processes scaled up for commercial supply. In addition, research collaborations with leading institutions and strategic commercial partnerships are enabling this disruptive technology to become a reality.

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We'd love to talk to you about research collaboration, partnerships and commercial 2D material supply.

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