HDPlas™ GNPs

Plasma Functionalised Graphene NanoPlatelets

Product Name:	HDPlas™ GNP
Synonyms:	Plasma Functionalised, Doped, NanoPlatelets, GNPs, NGPs, Graphene, Graphite
Chemical Family:	Surface Modified Graphite in the form of Graphene Nanoplatelets
Properties:	Electrically Conductive, Mechanically Stable, Exfoliates into Graphene Sheets
Product Uses:	Mechanical, Electrical and Thermal enhancements

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About the Materials

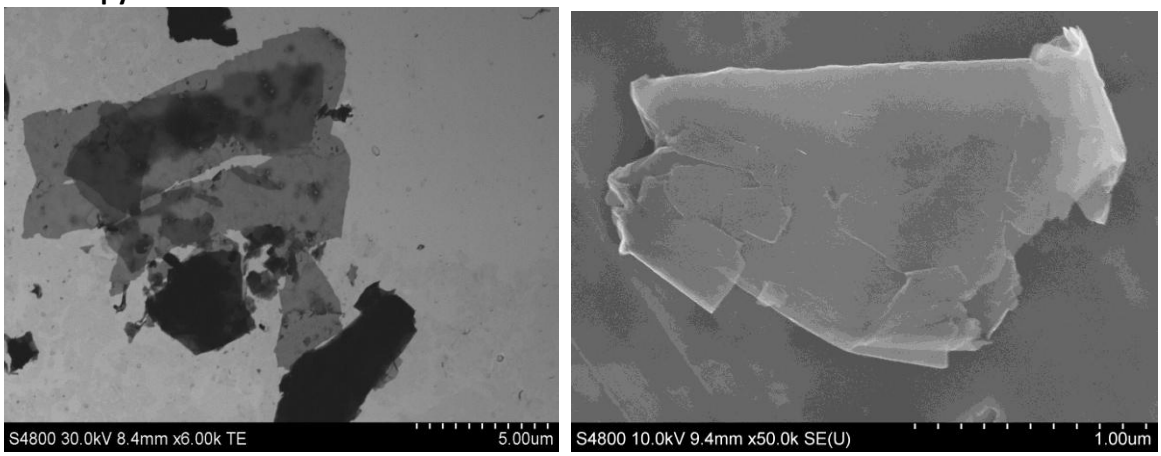
HDPlas™ GNPs are small particles of graphene containing nanoplatelets which have been plasma processed to modify the surface of the nanomaterials for enhancements in application. The plasma process imparts chemical species onto the surface of the GNPs which improves the compatibility with matrix materials. Plasma surface modifications do not penetrate into the bulk of these materials, and therefore does not damage the structural integrity and related properties. Plasma functionalised materials can be dispersed much easier than raw untreated materials. HDPlas™ GNPs are available from research to industrial quantities (1 g – 100 kg) and can be provided as dry powders, dispersions or integrated into a polymer system removing the barriers to nanotechnology.

Standard Data*

Data	Measurement	Method
Production Method	Plasma Exfoliation of Graphite	
Colour	Black/Grey	Visual
Bulk Density	215kg/m^3	EN ISO 60
True Density	2.2 g/cm^3	Theoretical
Amorphous Carbon	Not Detected	SEM/TEM
Specific Surface Area	~25 m^2/g	BET Analysis
Typical GNP Planar Size	0.3 – 5 µm	SEM
Typical GNP Thickness	<50 nm	SEM
Resistivity	0.01 – 0.03 Ωm	Compressed 50 N load

* Results shown are typical values

Electron Microscopy



Typical micrographs for all HDPlas™ GNP products

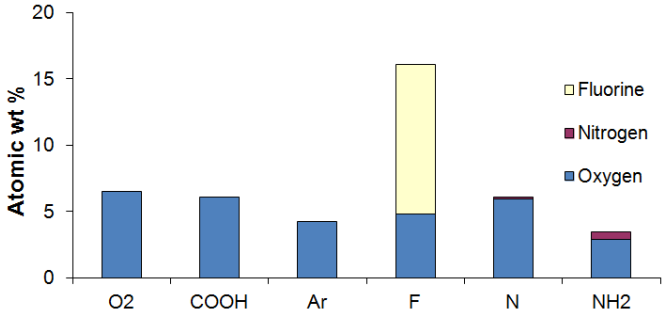
Standard Products

Product Name	Functionalities*	Application Notes
HDPlas™ GNP - O2	Carbonyl [C=O] Hydroxyl [OH]	Excellent dispersion and compatibility with polar solvents and polymers
HDPlas™ GNP - COOH	Carboxyl [COOH] Carbonyl [C=O]	Compatibility with a number of polymers, including alkene and resin chemistries. Carboxyl groups are a reactive chemical species which finds use in a large variety of applications.
HDPlas™ GNP - Ar	Radicals	Plasma activated surface, which is highly reactive
HDPlas™ GNP - F	Fluorinated Carbon [(CF)n]	Fluorine functional surface chemical groups which are non-polar and therefore hydrophobic.
HDPlas™ GNP - N	Nitrous Oxide [NOx] Imine [=C=N]	Nitrogen containing functional groups – produced in a non-oxidising atmosphere, lending itself to some polymer and specialised electronic applications.
HDPlas™ GNP - NH2	Amines [NH_x] Amide [RCONH2] Nitrous Oxide [NOx]	Useful in some solvents, polymer systems and electrical applications.
Metallic Sputtering	Haydale can provide nanomaterials which have been sputtered with metals through a PE-CVD process. Discuss your requirements with us.	
Dispersions and Polymers	Haydale can provide customers with bespoke dispersions and nano-loaded polymers, including thermoset resins, thermoplastic polymers and solvent dispersions.	

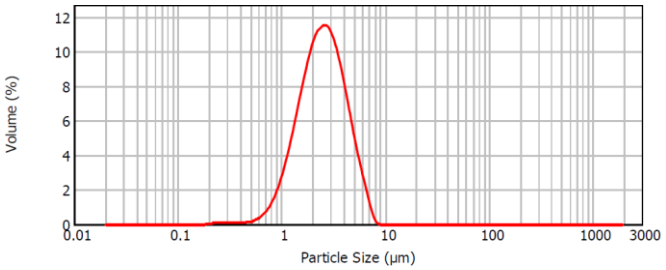
* As observed in practical functional groups produced by split plasma processing

Technical Data

XPS Analysis of HDPlas™ GNPs



HDPlas™ GNP – Secondary particle size distribution (DLS)



D0.1 = 1.3 µm d0.5 = 2.6 µm d0.9 = 4.8 µm

Disclaimer: Haydale HDPlas™ give no guarantee regarding the behaviour of these materials during handling, processing or product use. The supplier shall not be liable for any damage arising out of use. All data is typical and should be used for guidance only.