

# DEVELOPMENTAL PRODUCTS

## ENGINEERED MULTI-WALL CARBON NANOTUBES

### PRELIMINARY INFORMATION

#### Introduction:

Graphistrength<sup>™</sup> multi-wall carbon nanotubes (MWNT) are produced in powder form as highly entangled MWNT bundles. Although this product form presents many advantages, in particular concerning handling and dosage, one of the main challenges remains the dispersion of MWNT. As a matter of fact, the ultimate goal when using Graphistrength<sup>™</sup> MWNT in any given application is to go from the initial bundle state to dispersion where every single nanotube is dispersed in the matrix or the liquid. Thus, the final properties will not only depend on the outstanding mechanical properties, and electrical and thermal conductivities of Graphistrength<sup>™</sup> MWNT but also on the process that is used to disperse them and the affinity between MWNT and the matrix or the liquid in which they are dispersed.

In its labs, Arkema is constantly improving its Graphistrength<sup>™</sup> range with new value-added products and has developed know-how and technologies to achieve a good dispersion of MWNT. Different Graphistrength<sup>™</sup> products are currently under development. Even though these new products are not yet commercially available, they can generally be obtained as samples in limited quantities. A short description of Arkema's main developments is given below.

#### Epoxy resins filled with Graphistrength<sup>™</sup> multi-wall carbon nanotubes:

In order to help its customers, Arkema has now developed a proprietary industrial process to properly disperse multi-wall carbon nanotubes in an epoxy resin. With a total concentration of multi-wall carbon nanotubes in the range from 1 to 3 %, these new Graphistrength<sup>™</sup> products can be directly used in manufacturing of epoxy-based composites filled with multi-wall carbon nanotubes.



#### Aqueous dispersions of Graphistrength<sup>™</sup> multi-wall carbon nanotubes:

Thanks to the specific polymer included in Graphistrength<sup>™</sup> 100 P50 pre-composite, optimum use can be made of MWNT properties within highly polar media and materials. In order to help its customers, Arkema has now developed a stable dispersion of Graphistrength<sup>™</sup> 100 P50 in water with a total concentration of multi-wall carbon nanotubes in the range from 1 to 4 %. These new Graphistrength<sup>™</sup> aqueous dispersions can be directly used in numerous waterborne industrial processes.

## Thermoplastic masterbatches filled with Graphistrength™ multi-wall carbon nanotubes:

Added in thermoplastics, Graphistrength™ MWNT bring numerous benefits to applications that require precisely controlling the electrical conductivity while optimally retaining the mechanical properties of the matrix. However, here also, desired properties are achieved only if the proper degree of MWNT dispersion is ensured.

In its compounding facilities, Arkema has now determined the key compounding parameters for different thermoplastic matrices. The first masterbatches filled with Graphistrength™ MWNT should be available for sampling soon.



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