

## WATER SOLUBLE MWCNT CONCENTRATE TECHNICAL DATA SHEET

### Description

Graphistrength® C W2-45 is a masterbatch that contains multi-wall carbon nanotubes (MWCNT) at high concentration of 45 % by weight, perfectly dispersed in Carboxyl Methyl Cellulose (CMC).

Graphistrength® C W2-45 is designed for the production of electrically conductive water-based formulations. Graphistrength® C W2-45 is provided in the form of pellets with the following key characteristics:

Property	Unit	Typical value <sup>(1)</sup>
Aspect		Black Pellets
MWCNT (2) content	wt %	45
CMC content	wt %	55

(1) Data not intended for specification purposes

(2) Graphistrength® MWCNT with purity > 90 %

### Benefits and applications

Graphistrength® C W2-45 can be diluted in various water-based formulations. Typical final MWCNT loadings in the final formulations are in the range of 1 to 3 wt% (2 to 6wt% of C W2-45 concentrate) depending on the formulation characteristics, targeted performances, processing methods and conditions. Typical electrical resistivity that can be achieved is in the range of 10 – 10<sup>8</sup> Ohm.cm. The ESD properties obtained with Graphistrength® C W2-45 are outstandingly consistent and uniform.

Graphistrength® C W2-45 is particularly interesting for its formulation flexibility thanks to the high concentration in MWCNT.

### Dispersion guide

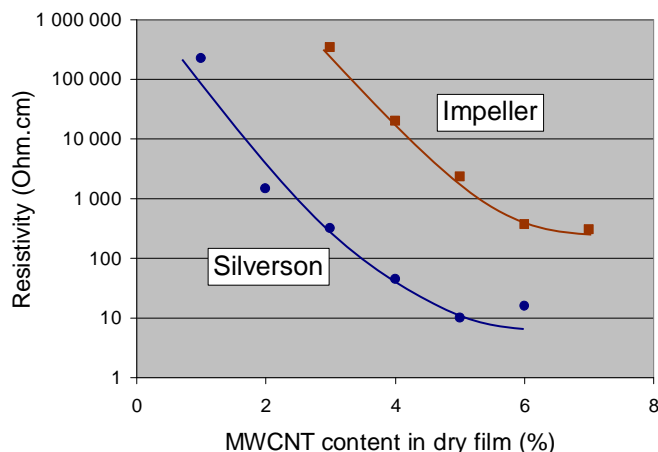
For optimal dispersion, the C W2-45 pellets should be immersed in hot water under mild agitation (300-500 rpm). After a few minutes, this dispersion is homogeneous but contains some aggregates. The dispersion can be optimized by high shear mixing. A detailed procedure is indicated below:

#### *Dispersion of C W2-45 step by step:*

1. Immerse C W2-45 pellets in hot water (70 – 90 °C) during at least 15 min under mild agitation (300-500 rpm).
2. Apply high-shear mixing to the suspension for at least 30 min. A dissolver disc (peripheral speed between 15 and 20 m/s) or a rotor-stator mixer (e.g. Silverson L4RT at 6,000 rpm or higher) can be used. Viscosifiers can be added prior to high shear mixing to increase viscosity and thus shear. This will result in better dispersion qualities or reduced dispersing times.
3. High shear mixing will result in water evaporation. Therefore, it is recommended to monitor and adjust the amount of water after the dispersion step if necessary.
4. Note that a minimal amount of water is required to achieve efficient solvation of MWCNT. Hence, low MWCNT concentrations (typically < 1wt%) will be more stable than higher MWCNT concentrations. Formulations containing more than 2 wt% of MWCNT will show some settling after a few hours.
5. Add the remaining components of the formulation, e.g. binder, filler, latex...

## Example of formulation and performance

- System: Water-based acrylic copolymer latex (formulation for paints with solid content of 44 wt%)
- Formulation: 3 g of Graphistrength® C W2-45 are immersed in 55 g of hot water for dispersion. Then at room temperature, 48 g of latex is added. The resulting paint is dried at room temperature.
- Electrical performance: 18 Ohm.cm  
(Silverson process; 1.3 wt% MWCNT in liquid formulation; 6 wt% in dried paint)
- Examples of percolation curves are shown below. Formulations were obtained from dispersions made with either impeller (500 rpm, 30 min) or Silverson (7,000 rpm, 30 min).



## Safety and Handling

Graphistrength® C W2-45 must be handled according to the Safety Data Sheet recommendations. Personal protection equipment includes: Dust mask FFP3, gloves, safety glasses and protective suit.

Graphistrength® C W2-45 is provided in dried pellet form.

Graphistrength® C W2-45 is provided in metallic drums of 1 kg, 5 kg and 50 kg net.

Graphistrength® C W2-45 should be stored in dry place, preferably in its sealed original container, at temperatures between 0 and 45°C. In these storage conditions, shelf life is more than one year.

Consult the product's safety data sheet for additional information on properties, hazards and handling.

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