

## WATER SOLUBLE MWCNT CONCENTRATE TECHNICAL DATA SHEET

### Description

Graphistrength® CW2-45 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® CW2-45 is designed for the production of electrically conductive water-based formulations.

Graphistrength® CW2-45 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® CW2-45 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 CW2-45 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® CW2-45 are outstandingly consistent and uniform.

Graphistrength® CW2-45 is particularly interesting for its formulation flexibility thanks to the high concentration in MWCNT.

### Dispersion guide

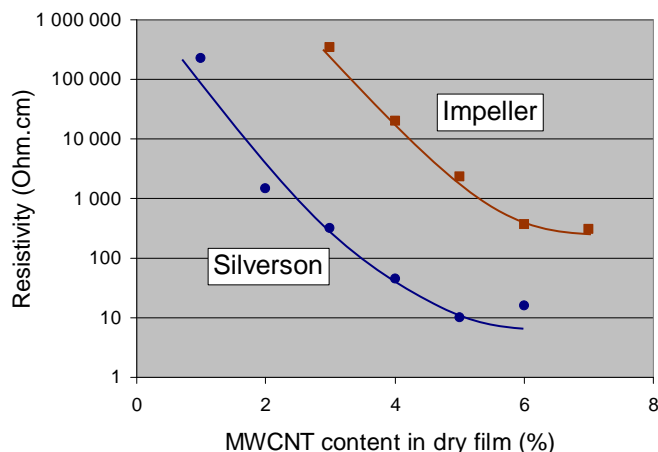
For optimal dispersion, the CW2-45 pellets should be added progressively in water under a certain agitation (1000-1500 rpm). After a few minutes, this dispersion is homogeneous but contains some aggregates. The dispersion can be optimized by high shear mixing. A detailed procedure is indicated below:

#### *Dispersion of CW2-45 step by step:*

1. Immerse CW2-45 pellets in hot water (70 – 90°C) during at least 15 min or in water at ambient temperature during at least 2 hours under a certain agitation (1000-1500 rpm), for example with a dissolver disc tool.
2. Apply high-shear mixing to the suspension for at least 30 min (for instance for 500-1000ml solution). 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. We suggest, to limit the water evaporation to put the flask in an iced bath, if possible put a top on the flask. 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...: final dispersion will more or less stable during storage: more stable with high concentration of MWCNT like 4% and more. Versus the final % of MWCNT in the dispersion, we recommend a minimum duration of storage (maximum of one month) and apply a certain agitation with dissolver disk tool if storage of the dispersion during a certain time before use.

## 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® CW2-45 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).
- Quality of the dispersion can be controlled with North Bar tool



## Safety and Handling

Graphistrength® CW2-45 must be handled according to the Safety Data Sheet recommendations. Personal protection equipment includes: Dust mask FFP3, gloves, safety glasses and protective suit.

Graphistrength® CW2-45 is provided in dried pellet form.

Graphistrength® CW2-45 is provided in plastic drums of 5 kg and carton drum with PE bag of 25 kg net.

Graphistrength® CW2-45 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.

Dispersion produced with this master-batch has to be stored in plastic drum.

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

## Contacts:

- [www.graphistrength.com](http://www.graphistrength.com)
- **Europe**  
Arkema France –  
Tel.: + 33 (0)5 59 92 66 07
- **Japan/Korea**  
Arkema K.K. –  
Tel.: + 81 (0)75 326 7515
- **North America**  
Arkema Inc. –  
Tel.: + 1 610 878 6992
- **Greater China**  
Arkema Shanghai –  
Tel.: + 86 021 61476888 ext 221

The information contained in this document is based on trials carried out by our Research Centers and data selected from the literature, but shall in no event be held to constitute or imply any warranty, undertaking, expressed or implied commitment from our part. Our formal specifications define the limit of our commitment. No liability whatsoever can be accepted by Arkema with regard to the handling, processing, or use of the product or products concerned - which must in all cases be employed in accordance with all relevant laws and/or regulations in force in the country or countries concerned.

The statements, technical information, and recommendations contained herein are believed to be accurate as of the date hereof. Since the conditions and methods of use of the product and of the information referred to herein are beyond our control, ARKEMA expressly disclaims any and all liability as to any results obtained or arising from any use of the product or reliance on such information; NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE GOODS DESCRIBED OR THE INFORMATION PROVIDED HEREIN. The information provided herein relates only to the specific product designated and may not be applicable when such product is used in combination with other materials, or in any process. The user should thoroughly test any application before commercialization. Nothing contained herein constitutes a license to practice under any patent and it should not be construed as an inducement to infringe any patent and the user is advised to take appropriate steps to be sure that any proposed use of the product will not result in patent infringement. See MSDS for Health & Safety Considerations.

Arkema – 420, rue d'Estienne d'Orves – 92705 COLOMBES Cedex – France

Tel.: + 33 1 49 00 80 80 - Fax: 33 1 49 00 83 96  
[www.arkema.com](http://www.arkema.com)

[www.graphistrength.com](http://www.graphistrength.com)

**ARKEMA**  
INNOVATIVE CHEMISTRY