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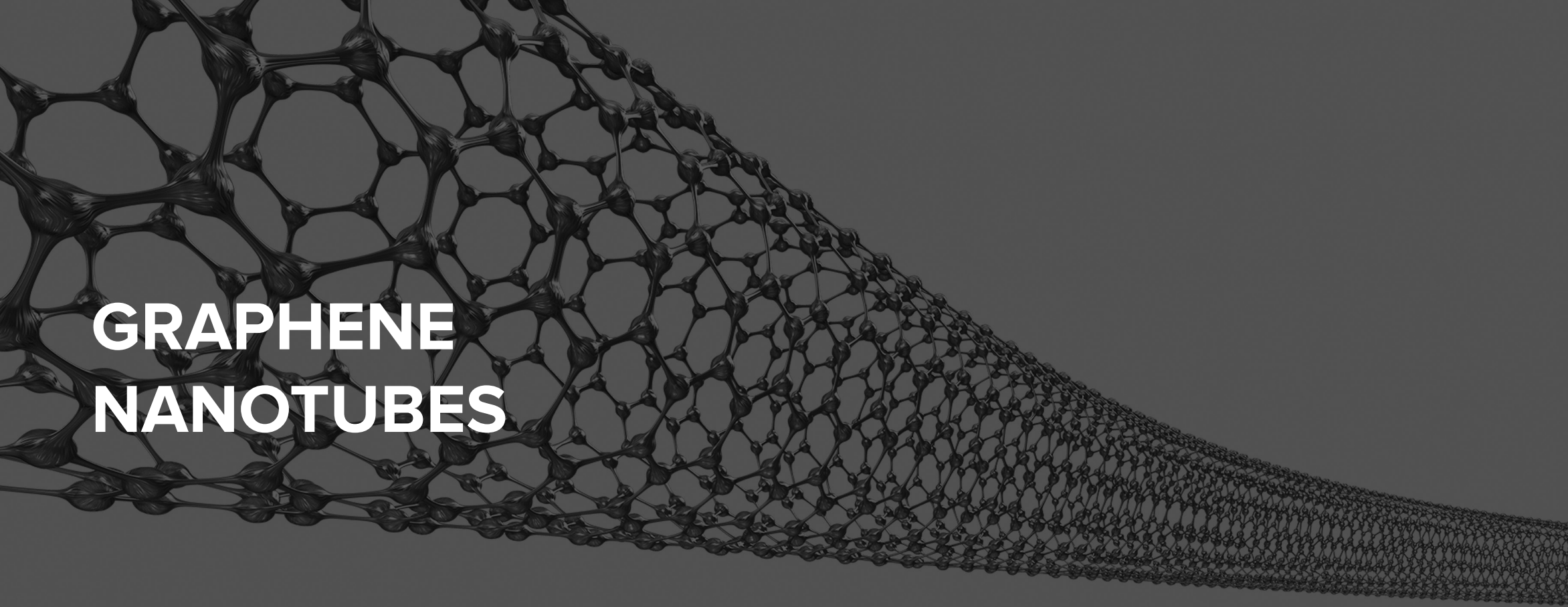
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PRODUCT CATALOG

MAY 2021

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GRAPHENE NANOTUBES

TUBALL™

Diameter

 1.6 ± 0.4 nm

Length

 >5 μ m

GRAPHENE NANOTUBES

Human existence is shaped by the materials we use. More than 70% of all basic materials can be improved by introducing a universal additive: single wall carbon nanotubes. These tiny tubes provide us with a rare opportunity to create nanoaugmented materials that have extraordinary properties.



Single wall carbon nanotubes (SWCNTs) should be referred to as graphene nanotubes (GNTs) because each nanotube is an extremely thin rolled-up sheet of graphene. The superiority of graphene nanotubes is due to their exceptional properties, such as superior conductivity, high temperature resistance, strength and flexibility.

TUBALL™

While the huge potential of GNTs has been recognised for many years, until recently their wide application in industry was not possible because of an absence of technology for their mass production, their high price, and a lack of methods for introducing them into materials.

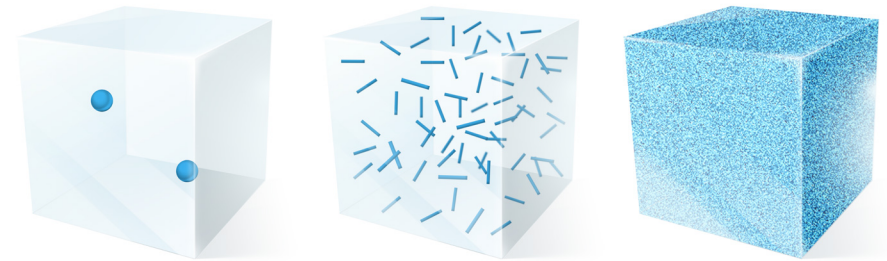
TUBALL™ nanotubes are the first GNTs to be available for commercial applications in a wide range of industries. OCSiAl's breakthrough yet low-cost mass-production technology has made the widespread use of nanotubes economically viable while still preserving their high quality.

FEATURES

- Best price-to-performance ratio compared with similar products
- Maintains color, elasticity, durability and other key properties
- Versatile for an extremely wide range of applications
- High-quality nanotubes (G/D ratio >90)
- Benefits start from ultra-low concentrations
- Adds uniform, permanent and stable electrical conductivity
- Enhances mechanical properties of materials

HOW IT WORKS

TUBALL™ provides significant improvements in material properties upon the addition of ultra-low loadings – starting from only 0.01%.



Microparticles

Nanofibers

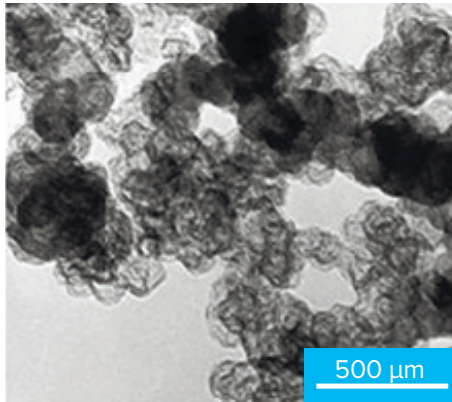
GNTs

The same concentration of particles (~0.1%) in the same volume.

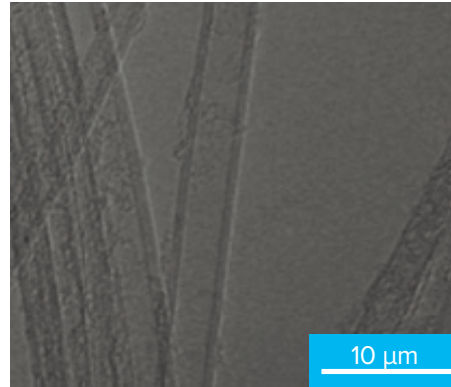
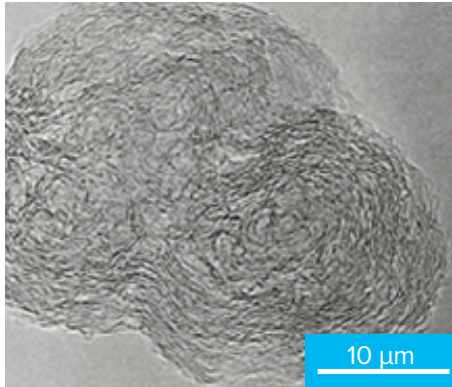
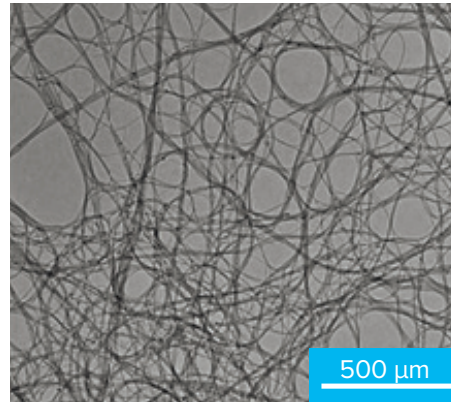
Unlike conventional additives such as multi wall carbon nanotubes, carbon fibers, and most types of carbon black that unevenly disperse in a material's matrix, GNTs create a 3D uniform reinforced and conductive network.*

NANOTUBES: THE ULTIMATE CARBON ADDITIVE

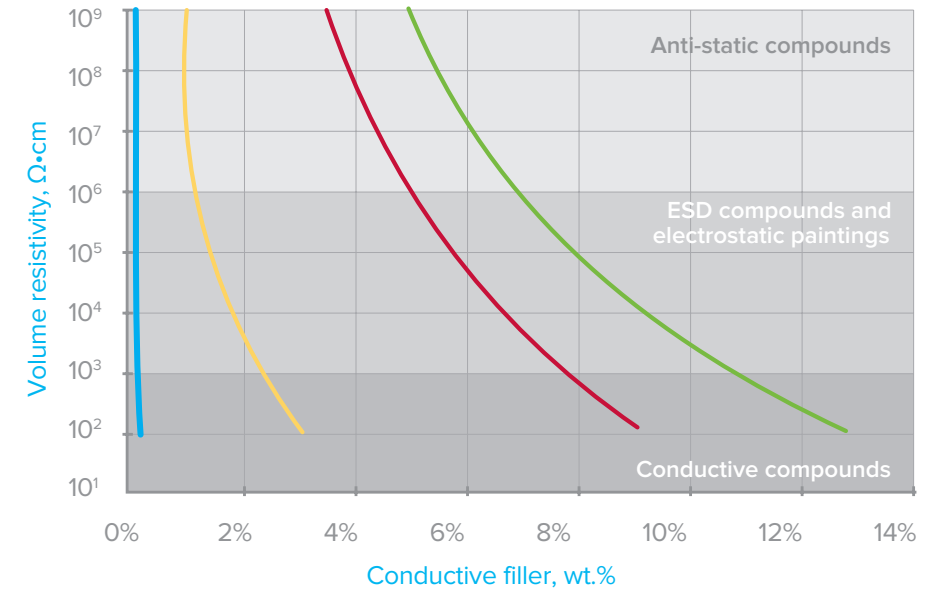
Conductive carbon black



TUBALL™ graphene nanotubes



THERMOSETS WITH TUBALL™ SHOW A SIGNIFICANT INCREASE IN CONDUCTIVITY



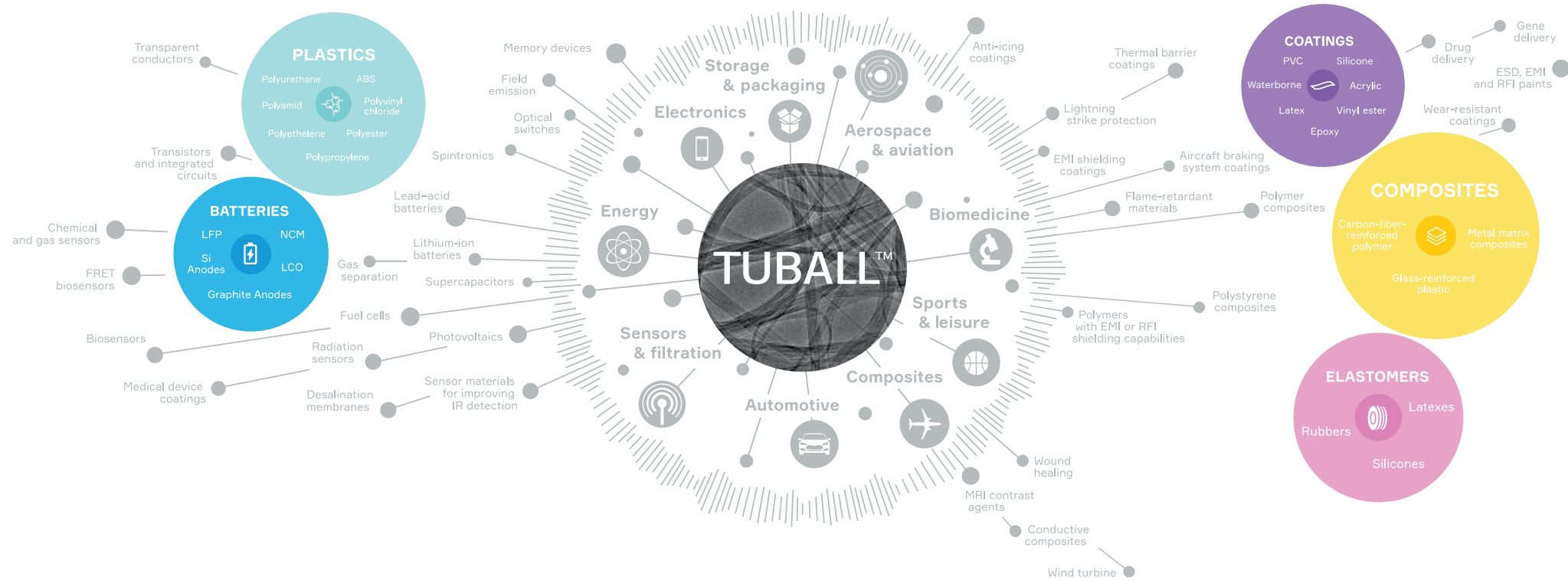
- TUBALL™ graphene nanotubes
- Multi wall CNT
- Premium carbon black
- Conductive carbon black

Results for unfilled polyester resin. ASTM D257.

TRULY UNIVERSAL ADDITIVE

To easily and properly incorporate TUBALL™ into materials, OCSiAl has developed and successfully brought to market a line of pre-dispersed concentrates, masterbatches and suspensions that are compatible with various industry-standard formulations.

For more information on TUBALL™ application in a specific matrix, refer to the product listing in the catalog or contact the nearest OCSiAl office for assistance in selecting the right solution.



A blurred, dark gray background image showing an electric car parked at a charging station. A charging cable is visible on the right side, plugged into the car. The overall tone is dark and modern.

PRODUCTS FOR ENERGY STORAGE

TUBALL™ BATT

TUBALL™ BATT is a ready-to-use dispersion designed to easily incorporate TUBALL™ into electrode formulations during the battery manufacturing process.

TUBALL™ BATT provides a complete or partial substitute for carbon black in battery electrodes and can replace several percent of carbon black with 0.03–0.1% of TUBALL™.

TUBALL™ forms conductive 3D networks between active material particles at very low concentrations. The nanotubes reinforce the electrode structure and improve its mechanical stability during cycling. TUBALL™ improves adhesion by establishing strong ties between the particles, reducing the amount of binder required.





TUBALL™ BATT H₂O

**Ultra-fine TUBALL™ dispersion in H₂O
for high-energy Si-based anodes**

CUSTOMER CASE

Customer: 3C battery maker

Product: Pouch cells for mobile phones

Why TUBALL™: Improving volumetric density of the battery is required

Dosage in recipe: 0.05%–0.1% of TUBALL™ in SiOx + graphite
in anode slurry recipe

The result: 800 Wh/l volumetric density is achieved with a good
cycle life performance

Nanotube dispersion in water creates a robust network inside the Si-anode and solves the problem of its degradation, allowing Li-ion battery makers to use record high quantities of silicon in the recipes of their cells for the first time and reach desired energy density targets, as well as unlocking fast-charging capabilities. The key element of Si-based anodes in the majority of silicon anode projects worldwide.

FEATURES

- Compatible with the majority of state-of-the-art SiO or Si/C anode recipes
- CMC or other binders available
- Low content of foreign impurities
- Ready, easy to use, efficient: proven by leading Li-ion battery makers

BENEFITS



Solves the Si-anode degradation problem

20% of SiO/C anodes with up to 600 mAh/g of capacity thanks to TUBALL™ BATT H₂O result in a battery cycle life acceptable to the modern EV industry



Record high energy density achievable

Boosts energy density up to 300 Wh/kg and 800 Wh/l due to Si-anode enabling



Fast-charging ability unlocked

Up to 4C charge-rate achievable due to high silicon content enabled by TUBALL™



Cycle life that meets the targets of the modern EV industry

Makes it possible to retain >80% capacity after 1,500 cycles



TUBALL™ BATT NMP

Ultra-fine TUBALL™ dispersion in NMP
for high-energy cathodes

CUSTOMER CASE

Company: Manufacturer of cylindrical batteries for various applications

Product: Cylindrical battery 18650

Why TUBALL™: Too much heat from high discharge rate mode as well as not enough power at lower temperatures

Dosage in recipe: 0.04%–0.08% of TUBALL™ in cathode slurry recipe

The result: DCR decreased significantly, improved continuous discharge rate at 0 °C

Unmatched TUBALL™ conductivity for improved battery safety and energy density now comes in a more cost-efficient and optimized dispersion.

FEATURES

- Dispersion optimized specially for cathodes
- More than 80% solids achievable
- Low Fe content
- Choice of PVDF possible
- Ready and easy to use

BENEFITS



Boosted energy density

Thanks to 10–60 times lower loading of conductive additive. Up to 98.8% active material content possible in dry electrode



Higher discharge power

Increases >50% at high discharge rates



Higher safety

Increased safety due to twice lower battery resistance increase (DCR)



Improved adhesion

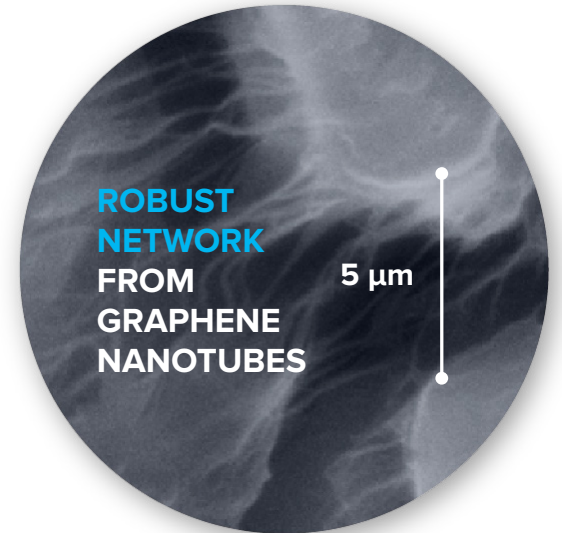
Twice higher thanks to the bond strength between cathode particles

ANODE

TUBALL™ graphene nanotubes cover the surface of the silicon particles and create highly conductive and durable connections between them. These connections are so dense, long, conductive and strong that, even when the silicon particles in the anode expand and the material starts to crack, the particles stay well connected to each other through the TUBALL™ graphene nanotubes. This prevents the anode from going out of service – the hugely improved cycle life is enough to meet even the most strict EV manufacturer requirements.

TUBALL™ UNLOCKS MASS PRODUCTION OF EV BATTERIES WITH SILICON ANODES

Bridging silicon anode particles and preventing their degradation during silicon volume expansion and cracking

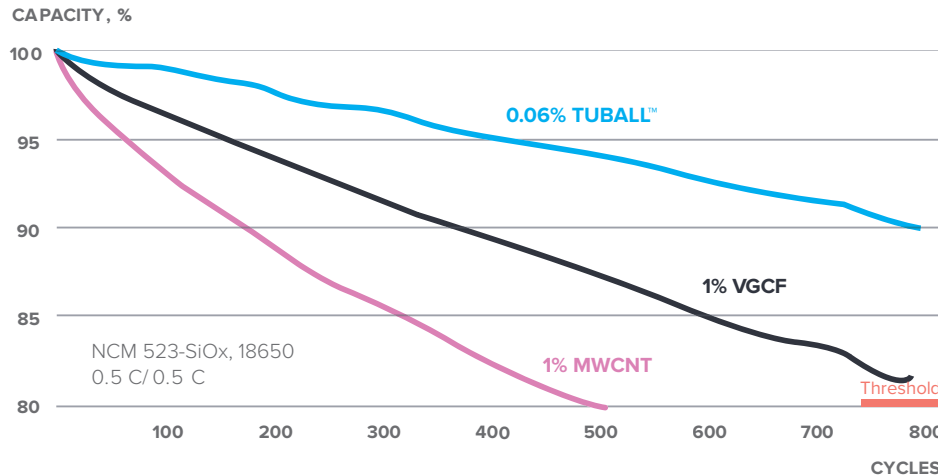


**ROBUST
NETWORK
FROM
GRAPHENE
NANOTUBES**

5 μm

TUBALL™ SOLVES THE SILICON ANODE PROBLEM – PREVENTING ITS DEGRADATION

TUBALL™ NETWORKS INCREASE SILICON-BASED ANODE CYCLE LIFE BY UP TO 4 TIMES

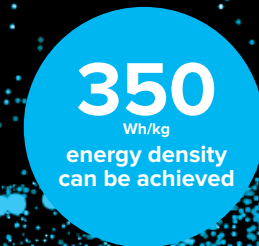


Leading Li-ion manufacturers have proven that TUBALL™ nanotubes make it possible today to create anodes containing 20% SiO and thus reach record-breaking battery energy densities – up to 300 Wh/kg and 800 Wh/l.

This enables fast-charging capabilities. Such battery cells can deliver up to +15% higher range than the best Li-ion battery cells on the market!

20% of SiO with TUBALL™ in Li-ion batteries is just the beginning

WE CAN GO FURTHER



OCSiAI R&D team results show that it's possible to increase the SiO content in anodes to 90%, which will result in energy density of 350 Wh/kg.

CATHODE

Thanks to their unique intrinsic properties, graphene nanotubes outperform alternatives and offer substantial Li-ion battery performance improvements in terms of energy density, safety, discharge power, and adhesion. Such performance improvements for Li-ion battery cathodes cannot be demonstrated by any traditional conductive additives, such as carbon black or multi wall carbon nanotubes.

TUBALL™ IMPROVES ALL KEY PARAMETERS

In comparison with MWCNT and carbon black cathode formulas:

SAFETY

higher due to

2×

lower battery resistance increase (DCR) during high-temperature (HT) storage and cycling

ENERGY DENSITY

higher due to

10–60×

lower loading

DISCHARGE POWER

higher

>50%

at high discharge rates >3C

ADHESION

higher up to

2×

nanotubes increase the bond strength between cathode material particles

Safety

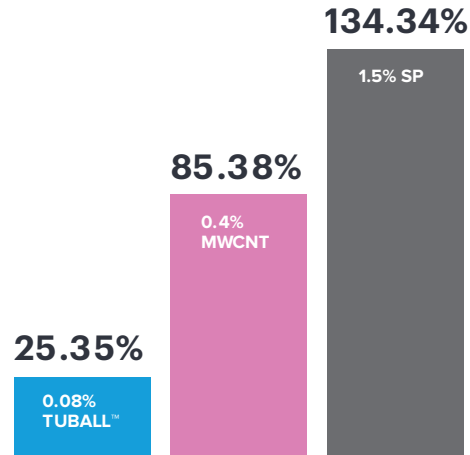
Being the most conductive material that can be used in the formulation of Li-ion batteries, even a small amount of TUBALL™ graphene nanotubes is enough to reduce internal battery cell resistance (DCR). Stable TUBALL™ networks are maintained inside the cathode material even after multiple battery charge–discharge cycles and battery storage periods, enabling the DCR to be maintained at a low level as well — after high-temperature storage and cycling.

60%

lower resistance increase during high-temperature battery storage

The lower battery DCR results in lower temperature build-up, and thus a reduced risk of a battery fire. This is a crucial safety benefit, made possible by TUBALL™ graphene nanotubes.

TUBALL™ DECREASES DCR



HT STORAGE. 60 °C, 21 DAYS
NCM811-GRAPHITE 1.5 AH POUCH

Energy density

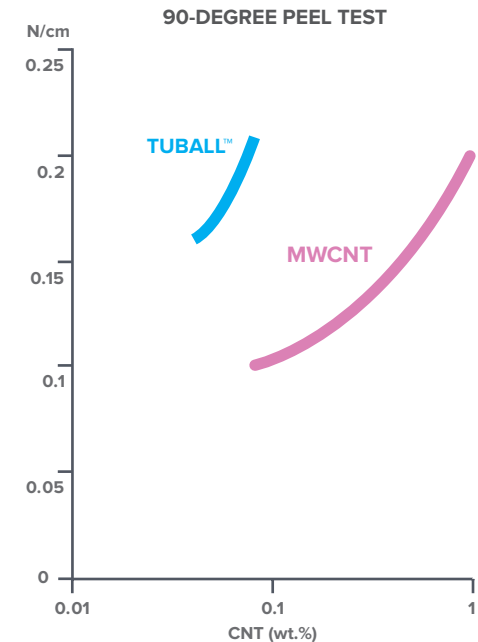
Less than 0.1% of TUBALL™ provides higher energy density. This concentration is lower by 10–60 times than that needed when using multi wall carbon nanotubes or carbon black as a conductive additive. In a modern EV battery pack, 5 kg of conductive carbon black can be replaced by just 100 g of TUBALL™.

Discharge power

Thanks to the unmatched conductivity of graphene nanotubes compared with other conductive additives, using TUBALL™ in cathodes makes it possible to achieve fast discharging while also increasing the battery's capacity.

Cathode adhesion

Nanotube networks hold the cathode material particles together, increasing the bond strength between them.



TUBALL™ BATT READY-TO-USE PRODUCTS FOR LIBs

	GNTs, %	DISPERSING AGENT, %	METAL IMPURITIES, PPM	DESCRIPTION
FOR CATHODES				
				ULTRA-FINE TUBALL™ DISPERSION IN NMP for high-energy and high-power cathodes
0.4% TUBALL™ BATT NMP	0.4%	PVDF 2%	<40	Maximizes energy density when used as a full or partial replacement of other conductive additives Boosts C-rate, and reduces impedance when used low dosage in combination with other additives
FOR Si/C ANODES				
				ULTRA-FINE TUBALL™ DISPERSION IN H₂O for high-energy Si/C anodes
0.4% TUBALL™ BATT H ₂ O	0.4%	CMC 0.6%	<40	Improves cycle life of Si/C anodes , enabling their industrial adoption in hi-energy cells >240 Wh/kg – benefits start. The more that high-energy-density anodes are used, the more essential is the application of TUBALL™ GNTs



PRODUCTS FOR ELASTOMERS

APPLICATION EXAMPLES



Non-marking solid tires



Cables



Textile coatings



Conveyor belts and rollers



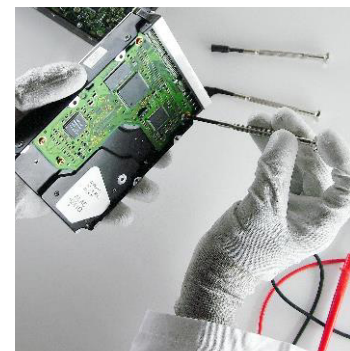
O-rings, hoses, jackets,
heat-resistant cords and plates



Pressure-sensitive adhesive film



Rubber seals



ESD gloves

TUBALL™ MATRIX FOR SILICONES

TUBALL™ MATRIX 601, 602 and 605 are nanotube concentrates specifically designed to provide superior electrical conductivity to silicone compounds (LSR – liquid silicone rubber, RTV – room temperature vulcanized rubber, and HCR – high consistency rubber) while retaining mechanical properties and minimally impacting the host matrix.



TUBALL™ MATRIX 601 / 602 / 605

PROPERTY — Electrical conductivity



TUBALL™ MATRIX 601
Carrier: polydimethylsiloxane oil

KEY APPLICATIONS

- LSR (liquid silicone rubber)
- RTV (room temperature vulcanised) silicones



TUBALL™ MATRIX 602
Carrier: vinyl-terminated polydimethylsiloxane

KEY APPLICATIONS

- LSR (liquid silicone rubber)
- HCR (high consistency rubber)



TUBALL™ MATRIX 605
Carrier: silicone gum

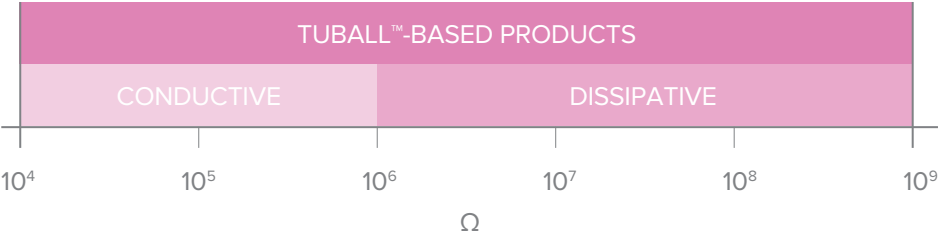
KEY APPLICATIONS

- HCR (high consistency rubber)

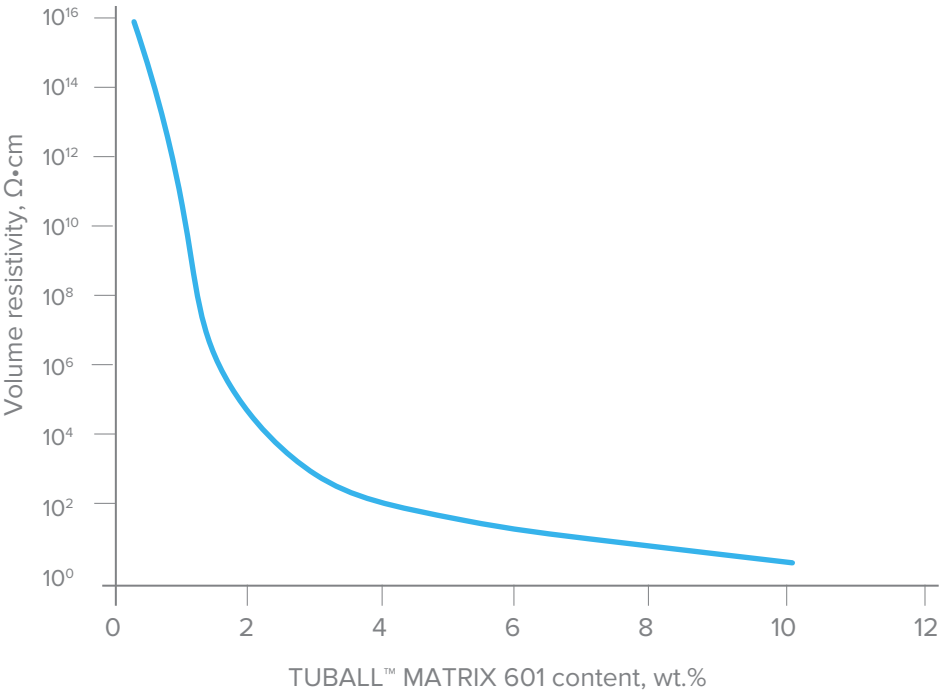
CONDUCTIVE SILICONES WITH TUBALL™ MATRIX

	Currently available	TUBALL™ MATRIX
Volume resistivity level	<100–10 ⁸ Ω•cm	<100–10 ⁸ Ω•cm
Concentration of conductive filler	30–70 wt.%	0.5–5 wt.%
Retain mechanical properties	No	Yes
Allow coloration	No	Yes

FULL RANGE OF RESISTIVITY

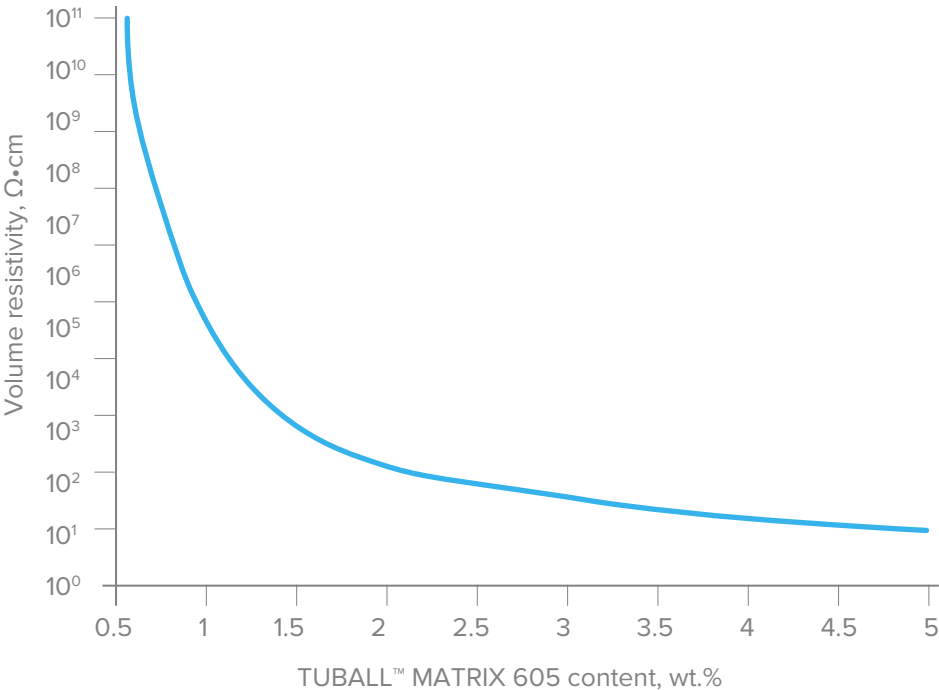


**VOLUME RESISTIVITY OF LSR SILICONE
WITH TUBALL™ MATRIX 601 IS IN THE RANGE 10–10¹⁶ Ω·cm***



* Tested in two-component LSR (Shore 40).
Measurements conducted according to ASTM D991.

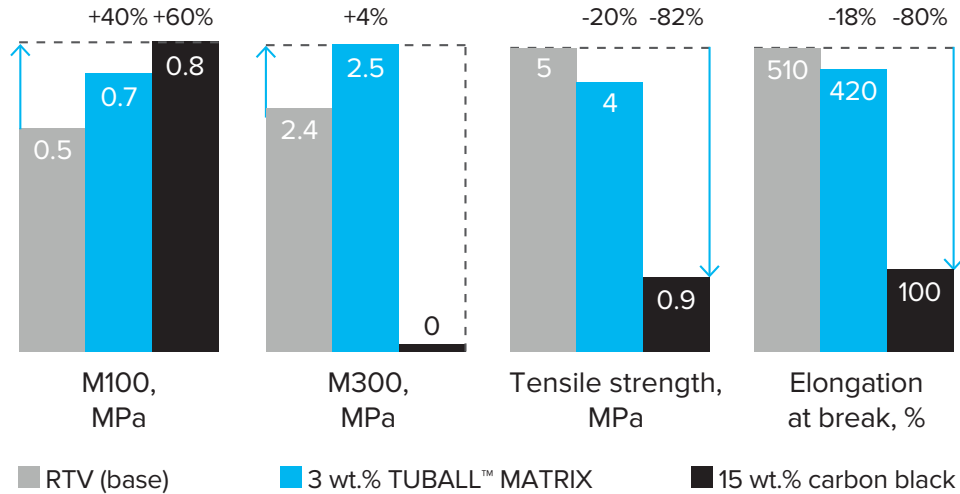
**VOLUME RESISTIVITY OF HCR SILICONE
WITH TUBALL™ MATRIX 605 IS IN THE RANGE <10–10¹¹ Ω·cm***



* Tested in HCR (Shore 60).
Measurements conducted according to ASTM D991.

PHYSICAL PROPERTIES OF RTV WITH 3 wt.% TUBALL™ MATRIX 601 IN COMPARISON WITH CONDUCTIVE CARBON BLACK

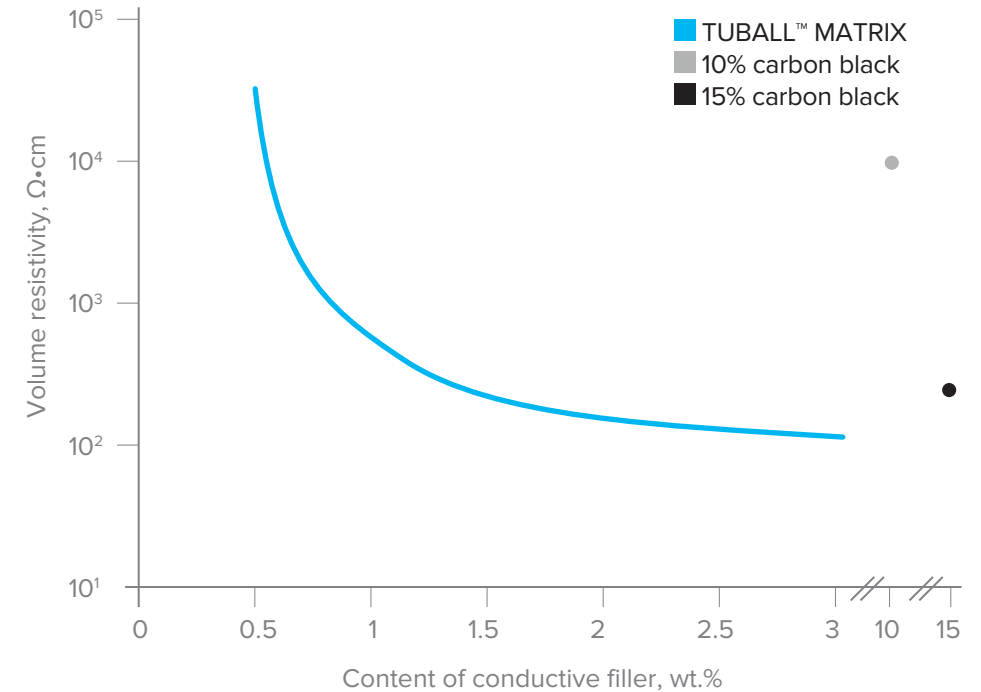
Volume resistivity 200 $\Omega \cdot \text{cm}$



TUBALL™ MATRIX makes it possible to produce conductive compounds without impairing flexibility or mechanical properties

* Measurements conducted according to ASTM D412.
Study was conducted with conductive carbon black VULCAN® XC72R.

VOLUME RESISTIVITY OF RTV SILICONE WITH TUBALL™ MATRIX 601 IN COMPARISON WITH CONDUCTIVE CARBON BLACK



* Measurements conducted according to ASTM D991.

TUBALL™ MATRIX FOR RUBBERS

TUBALL™ MATRIX 600s are nanotube concentrates designed to impart required electrically conductive properties to rubbers and to significantly enhance their mechanical properties.



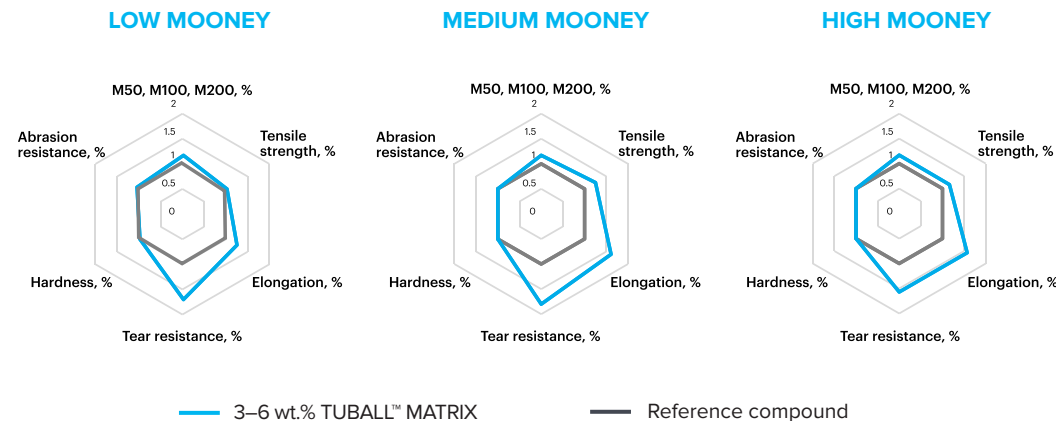
FEATURES OF TUBALL™ MATRIX FOR RUBBERS:

- Suitable for anti-static, static dissipative, and conductive applications
- Extremely low loadings of nanotubes that preserve properties
- Retain mechanical properties including softness
- Maintain rheology and viscosity
- Standard processing and mixing equipment
- Allows for colored ESD compounds

Ensuring long service life and stable conductive properties to crucial products and processes, nanotube-modified rubbers are widely used in the electronics, automotive, and tire, oil & gas, and other industries.

OCSiAl has developed a variety of products based on TUBALL™ graphene nanotubes for EPDM, NBR, SBR, blends of NR/BR, FKM, and other types of rubbers.

IMPROVEMENT OF TEAR STRENGTH AND TENSILE PARAMETERS NO NEGATIVE IMPACT ON ELASTICITY



- M50, M100, M200 increased by 15–20%
- Tensile strength increased by 16–23%
- Tear resistance increased by 25–103%

- Abrasion resistance increased by 3–11%
- No drawback in elasticity
- Electrical resistivity 10^6 – 10^9 Ω·cm



TUBALL™ LATEX

TUBALL™ LATEX is a water-based suspension for manufacturing latex gloves and latex products with anti-static properties, while retaining mechanical properties and minimally impacting the host matrix.

TUBALL™ LATEX makes it possible to attain permanent and humidity-independent conductivity that is fully compliant with the most demanding applications, including the new European standard EN 16350:2014 (EN 1149) for anti-static properties in safety wear.



TOUCHSCREEN OPERATION WITH INDUSTRIAL GLOVES

TUBALL™ graphene nanotubes provide an anti-static effect that allows smooth operation of touchscreens without gloves having to be removed and that ensures worker and product protection.

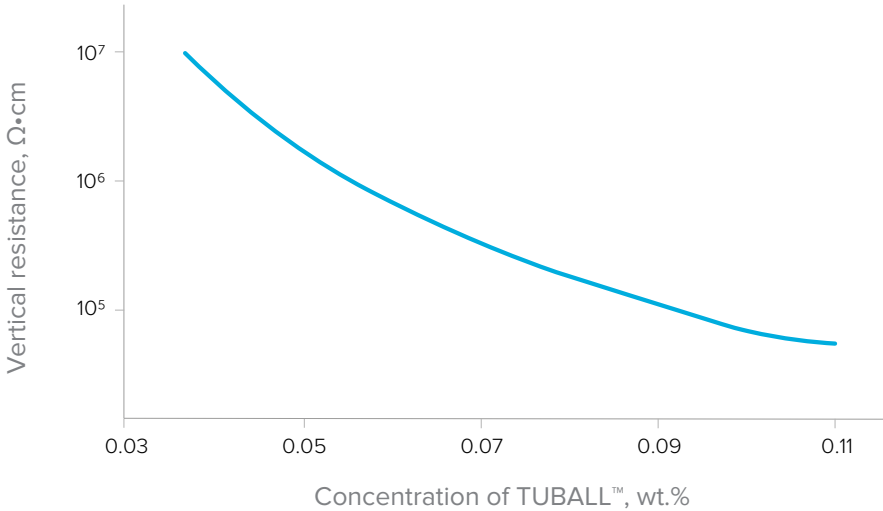
KEY BENEFITS

- Stable ESD properties according to international standards for protective wear
- Standard liners without conductive yarns
- No changes in formulation or dipping process
- Allows coloration



ANTI-STATIC NITRILE LATEX WITH TUBALL™

	Current solutions	Results with TUBALL™
Specific resistivity level	$10^7 - 10^{11} \Omega \cdot \text{cm}$	$10^2 - 10^{11} \Omega \cdot \text{cm}$
Concentration of conductive filler	5–25 wt. %	0.03–0.075 wt. %
Negative impact on mechanical properties	Yes	No
Color retention	Yes	Yes



Measurement of electrical resistivity according to EN 16350:2014 carried out on teraohmmeter: TO-3 cable; electrode type - TE 50 for textile measurement (DIN 54345-1, DIN EN 1149-1 and DIN EN 1149-2)

ESD GLOVES WITH TUBALL™ PU & NITRILE LATEXES

LINER PU GLOVE
industrial
0.06 wt.%



NITRILE LATEX FILM
cleanroom
0.06 wt.%



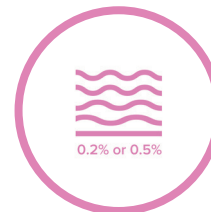
LINER NITRILE GLOVE
industrial*
0.06-0.1 wt.%



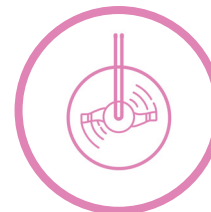
ELECTRICAL RESISTIVITY $10^7 \Omega \cdot \text{cm}$

*Gloves made by industrial partners with TUBALL™

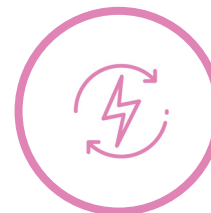
HOW TO MAKE YOUR GLOVES CONDUCTIVE WITH TUBALL™



User-friendly water-based dispersion
available in two concentrations of TUBALL™



Standard compounding and dipping process



Touchscreen gloves compliant with international
standards for protective wear

TUBALL™ GRAPHENE NANOTUBE SOLUTIONS FOR ELASTOMERS

PRODUCT	CARRIER MEDIUM	TARGET SYSTEM					
		LSR silicone	RTV silicone	HCR silicone	EPDM	NR latex	NBR, PU latex
SILICONES							
	Polydimethylsiloxane	●	●				
	Siloxanes and silicones vinyl group-terminated	●	●	●			
	Siloxanes and silicones vinyl group-terminated			●			
LATEX							
	Water, anionic surfactant					●	●
RUBBERS							
	Polymer, paraffinic mineral oil				●		

The background image shows a vast industrial interior, likely a manufacturing plant for composites or coatings. The floor is exceptionally reflective, mirroring the green structural columns and the overhead equipment. In the distance, several workers in safety gear are visible, providing a sense of scale to the large space. The lighting is bright, creating strong reflections on the polished surface.

PRODUCTS FOR COMPOSITES & COATINGS

TUBALL™ MATRIX 200 / 300s

TUBALL™ MATRIX 200 / 300s are nanotube concentrates designed to provide permanent, uniform electrical conductivity to various materials: epoxy, polyurethane, polyester, etc. TUBALL™ MATRIX is compatible with a variety of color shades while meeting ESD standards.



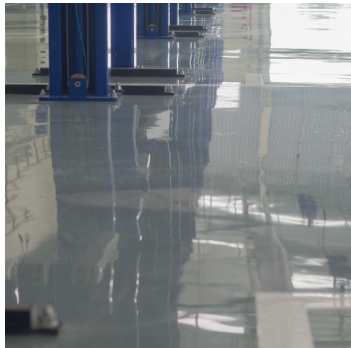
APPLICATION EXAMPLES



GFRP pipes



Equipment for mines, electronics, chemical plants and petrol stations



Epoxy and PU anti-static flooring



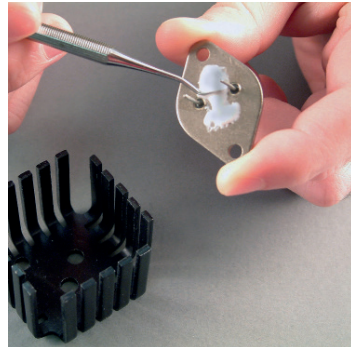
Gelcoats and moldcoats



Equipment in clean rooms



Housing/packaging for sensitive electronics, and combustible powders or liquids

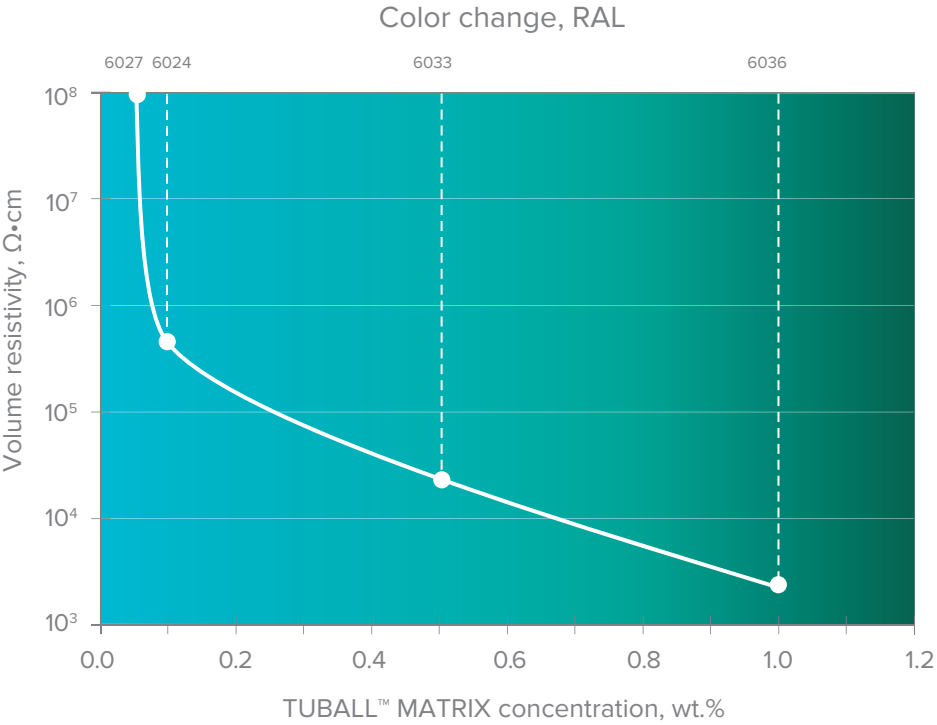


Epoxy and PU conductive adhesives



Conductive primers for plastic components

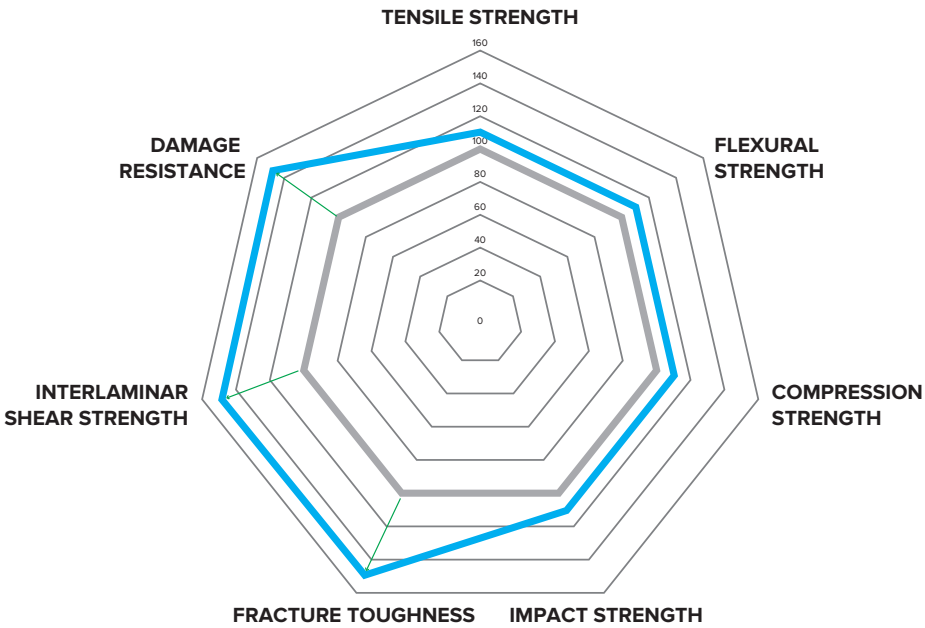
TUBALL™ MATRIX CONDUCTIVITY AND COLOR



Note: all samples include 5 wt.% of TiO₂ as a whitening agent.
Results for epoxy resin D.E.R. 351.

EXPECTATIONS: ENHANCED BY TUBALL™ MATRIX

+20–60% improvement +5–10% improvement



— Neat composites
— TUBALL™

DECREASED CREEP

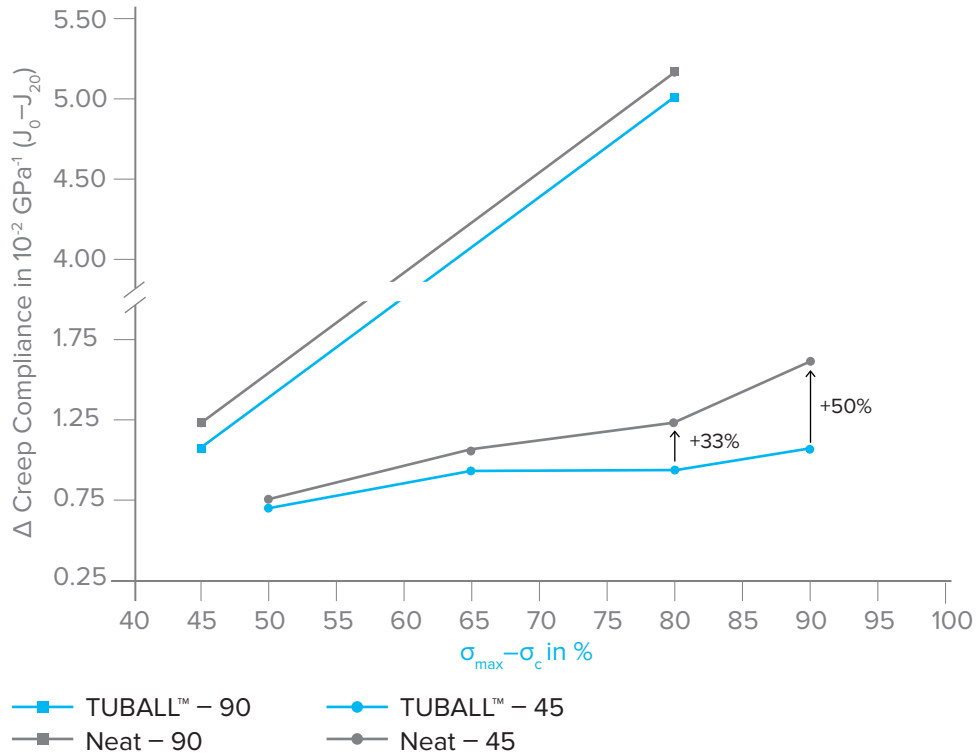
For fiber-reinforced composites

NET COMPOSITES

Δ Creep Compliance in $10^{-2} \text{ GPa}^{-1} 1.5$

COMPOSITES WITH 0.05% of TUBALL™

Δ Creep Compliance in $10^{-2} \text{ GPa}^{-1} 1.0$



Maximum creep compliance achieved after 20 hours of constant loading in dependence of the applied stress level for tested configurations.

A significant increase in creep resistance is shown for the 0.05 wt.% TUBALL™-modified systems especially at high stress level in transverse direction.

RESIN

Epoxy hotmelt system (R 481/H 482)

FIBER

Carbon fiber Grafil 34-700 (MITSUBISHI RAYON)

- tensile strength 4.83 GPa
- tensile modulus 234 GPa
- density 1.8 g/cm³

FABRICATION

Prepreg + autoclave

MEASUREMENT STANDARD

DIN EN ISO 527-5

VALIDATED BY

TUHH
Technische Universität Hamburg-Harburg

TUBALL™ COAT_E

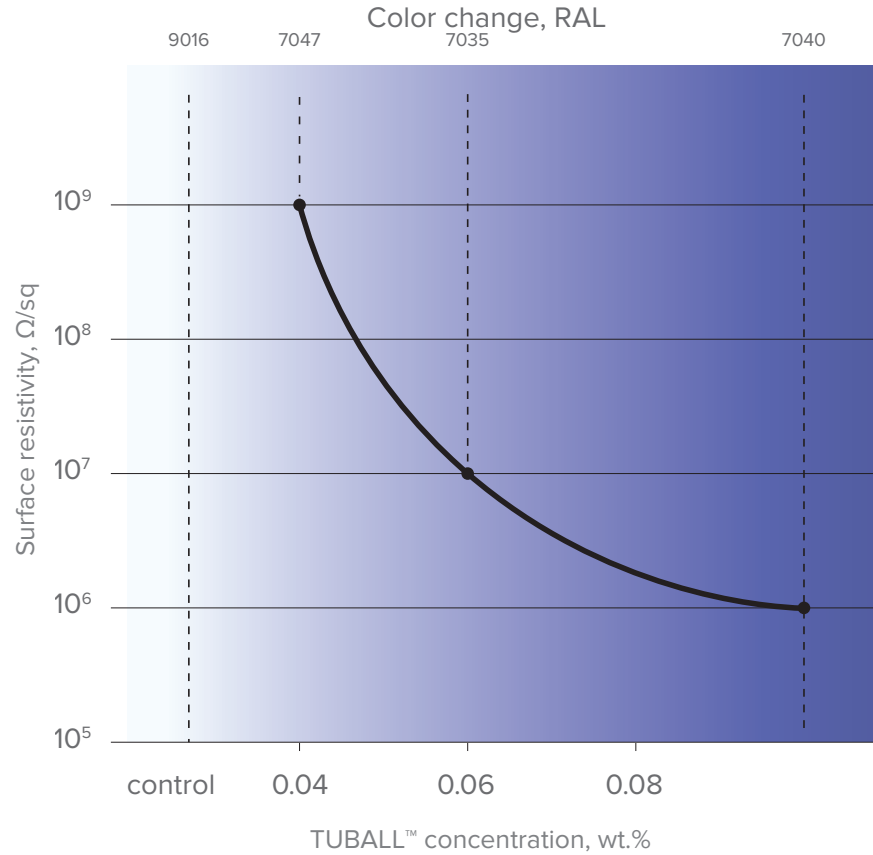
TUBALL™ COAT_E is an easy-to-use single wall carbon nanotube suspension in water that provides permanent anti-static properties to waterborne paints and coatings with minimal impact on their color and mechanical properties.

TUBALL™ COAT_E is suitable for production of anti-static waterborne paints and coatings intended for the following applications:

- UV coating
- Packaging for electronics

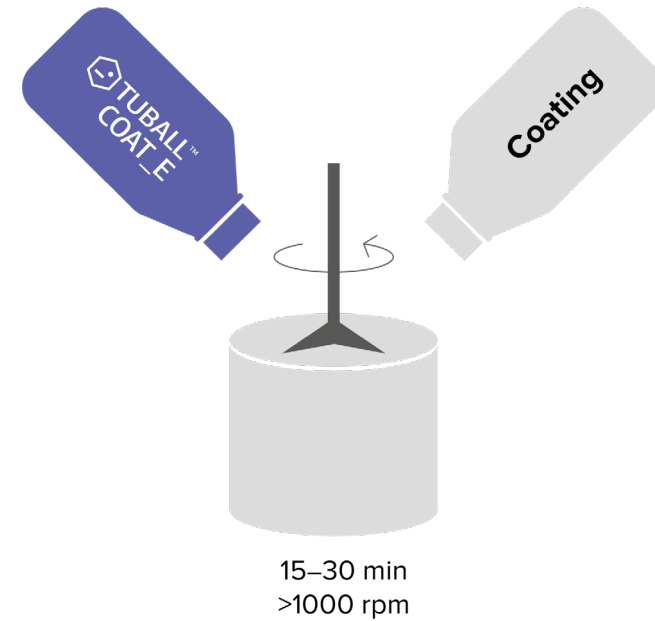


TUBALL™ COAT_E IS SUITABLE FOR COLORED AND TRANSPARENT SYSTEMS



Permanent electrostatic dissipative and conductive properties with color and/or transparency are achieved by simply mixing TUBALL™ COAT_E with the paint system.

- Easy to use
- Efficient ESD protection
- Permanent conductivity
- Suitable for colored and transparent systems



TUBALL™ GRAPHENE NANOTUBE SOLUTIONS FOR COMPOSITES & COATINGS

PRODUCT	CARRIER MEDIUM		TARGET SYSTEM														
			SOLVENT-FREE					SOLVENT-BASED							WATER-BASED		
	SHORT	FULL	Epoxy	Polyester	Vinyl-ester	Polyurethane	Phenolic	Epoxy	Polyester	Vinyl-ester	Polyurethane	Melamine	Phenolic	Acrylic	Epoxy	Polyurethane	Acrylic
CONCENTRATES																	
MATRIX 201	Plasticizer	Fatty acid glycidyl ester	●														
MATRIX 202	Plasticizer	Fatty carboxylic acid ester derivatives				●	●										
MATRIX 203	Plasticizer + stabilizing agent	Fatty acid glycidyl ester + ammonium salt of polyolefin-based derivatives						●			●						
MATRIX 204	Plasticizer + stabilizing agent	Triethylene glycol dimethacrylate + ammonium salt of polyolefin-based derivatives		●	●				●	●		●		●			
MATRIX 205	Plasticizer + stabilizing agent	Fatty carboxylic acid ester derivatives + ammonium salt of polyolefin-based derivatives											●				
MATRIX 207	Plasticizer	Alkyl glycidyl ether	●														
MATRIX 208	Plasticizer + stabilizing agent	Alkyl glycidyl ether + ammonium salt of polyolefin-based derivatives						●			●						
MATRIX 209	Plasticizer	Fatty carboxylic acid ester derivatives				●	●										
MATRIX 301	Surfactant	Ethoxylated alcohol	●			●											
MATRIX 302	Surfactant + stabilizing agent	Alkylene glycol derivative + distyryl biphenyl derivative													●		●
SUSPENSIONS																	
COAT_E H ₂ O (SDBS) *	Water + anionic surfactant	Water + sodium dodecylbenzenesulfonate													●	●	●

*0.2% or 0.4% of TUBALL™ concentrations are available



PRODUCTS FOR THERMOPLASTICS

TUBALL™ MATRIX 800s

Currently, OCSiAl markets nanotube-based concentrate for PVC-plastisol. Other anti-static additives with nanotubes for polyethylene, polypropylene, polystyrene, ABS, polyamide, and polycarbonate are undergoing validation and are referred to as beta products.



APPLICATION EXAMPLES



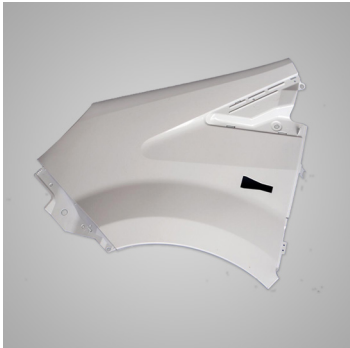
Anti-static packaging produced by rotational molding



Ventilation ducting



ABS injection molded parts



Automotive parts



Semiconductive shielding materials



Textiles

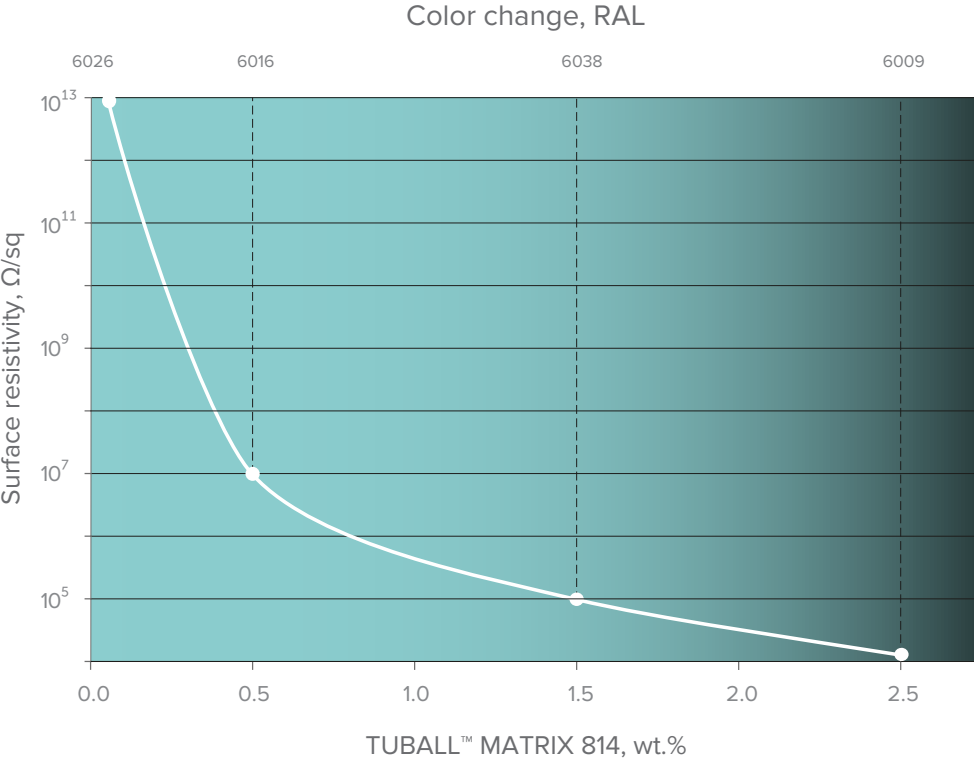


Filled polyamide injection-molded part



Treadmill belts

MINIMAL IMPACT ON THE ORIGINAL COLOR OF COMPOUND



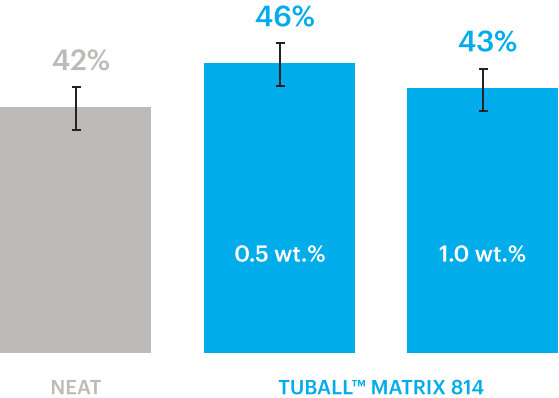
OCSiAl internal PVC plastisol formulation
Sample thickness: 2 mm. ASTM D257

FEATURES OF TUBALL™ MATRIX FOR THERMOPLASTICS:

- Ultra-low dosage starting from just 0.5 wt.%
- Maintains or even increases mechanical strength
- Ensures permanent and uniform electrical conductivity without “hot spots”
- No significant increase in viscosity or density of the host material
- In specific applications, allows production of conductive parts with colors

TUBALL™ MATRIX 800 line is designed for the most demanding applications in the automotive, petrochemical, oil and gas, healthcare, pharmaceutical, and electronics industries.

MAINTAINED ABRASION RESISTANCE INDEX



OCSiAl internal PVC plastisol formulation. ASTM D5963-04

SAFETY INFORMATION

OCSiAl produces nanotube dispersions and concentrates to enable a simple and easy integration process. TUBALL™ MATRIX products and TUBALL™ suspension products were developed to minimize handling requirements and provide all manufacturers access to the superior performance of single wall carbon nanotubes.

For handling and safety information please refer to the Material Safety Data Sheet and Safe Handling guide for the corresponding product.



More at tuball.com

WARRANTIES AND DISCLAIMER

The Products correspond to the chemical composition indicated in the Technical Data Sheet and the Material Safety Data Sheet supplied with the Product. The information contained in this document (Information) is based on trials carried out by OCSiAl and may contain inaccuracies or errors that could cause injury, loss, or damage.

OCSiAl gives no further warranty and makes no further representation regarding the Products and/or the accuracy of Information and/or suggestions for any particular use of the Products or Information, or that suggested use will not infringe any patent. The Products and Information are supplied on an “as is” basis. These express provisions are in place for all warranties, representations, conditions, terms, undertakings, and obligations implied by statute, common law, custom, trade usage, course of dealing, or otherwise (including implied undertakings of satisfactory quality, conformity with description, fitness for purpose, and reasonable skill and care), all of which are hereby excluded to the maximum extent permitted by applicable law.

TUBALL CENTERS

OCSiAl has created a network of international research and development centers — TUBALL CENTERS — to provide high-quality technical support and research data for our customers

These centers are located in the key markets for the company and are served by the most experienced team in the field of graphene nanotubes, maintaining the highest research standards and prompt technical support.

The company focuses particularly on Li-ion batteries, where OCSiAl has created two state-of-the-art development centers for Li-ion batteries to develop and test new battery products based on graphene nanotubes, and to offer professional support.

●
TUBALL™ CENTER
NOVOSIBIRSK

●
TUBALL™ CENTER
LUXEMBOURG

●
TUBALL™ CENTER
SHANGHAI



ABOUT OCSiAl



OCSiAl is an international advanced materials company commercializing breakthrough technologies for the synthesis of high quality industrial carbon nanomaterials.

OCSiAl was founded by a group of like-minded visionaries who identified the fundamental need for clean materials and understood the reality that graphene nanotubes (GNTs) are the only universal additive with mechanical, thermal and electrical properties capable of improving the composition of more than two-thirds of all materials used in industrial production.

Today, OCSiAl employs over 420 scientists, engineers, technologists, designers, industry vendors, and managers working in 20 countries. With experts in physics, chemistry, nanomaterials, and other scientific fields at the core of OCSiAl's R&D and product development, OCSiAl has one of the most experienced teams in the nanomaterials industry.

OCSiAl FACILITY
TECHNOPARK, NOVOSIBIRSK, RUSSIA



CONTACT YOUR LOCAL DISTRIBUTOR TO ORDER A SAMPLE AND OBTAIN TECHNICAL/SAFETY DATA SHEETS

ASIA

KOREA

208, Gaetbeol-ro 12,
Yeonsu-gu, Incheon,
21999, Korea
+82 32 260 0407
asiapacific@ocsial.com

HONG KONG

Room 1102, 11/F, Lippo Sun
Plaza, 28, Canton Road,
Tsim Sha Tsui, Kowloon,
Hong Kong
+852 3575 3946

CHINA

#2004, 20th floor, Tower B,
Da Chong Business Centre,
Yue Hai Street, Nanshan
District, Shenzhen,
Guangdong, China
+86 755 867 00059

Ground floor, Unit 4,
Building 7, No.160, Basheng
Road, Pudong district,
Shanghai, China
+86 135 9012 5295

china@ocsial.com

JAPAN

Tokyo, Japan
070-1421-0331
japan@ocsial.com

INDIA

Vimal intertrade PVT Ltd,
Shivam centrium, Sahar road,
Koldongri, Andheri East,
Mumbai, 400 069, India
+ 91 22 6288 4200
india@ocsial.com

NORTH & SOUTH AMERICA

USA

500 S Front St,
Suite 860, Columbus,
OH 43215, USA
+1 415 906 5271
usa@ocsial.com

EUROPE

LUXEMBOURG

1 Rue de la Poudrerie,
L-3364, Leudelange,
Grand Duchy of Luxembourg
+352 27990373
europe@ocsial.com

RUSSIA

Kalanchevskaya Str., 29,
bld. 2, Moscow, 107078,
Russia
+7 499 6535152

Inzhenernaya Str., 24,
Novosibirsk, 630090,
Russia
+7 383 201 8387

russia@ocsial.com

tuball.com
ocsial.com