



MASTERBATCH FOR SILICONE APPLICATIONS

GENERAL INFORMATION

TUBALL™ MATRIX is a line of concentrates based on TUBALL™ single wall carbon nanotubes (SWCNT) produced by OCSiAl. TUBALL™ MATRIX concentrates are available in several matrixes, are easy to handle, and can be processed using standard equipment. Depending on the TUBALL™ MATRIX percentage in the final compound and the processing conditions and other system components, the volume resistivity can be adjusted within the range of 10^8 – $10 \Omega \cdot \text{cm}$.

TUBALL™ is a unique SWCNT additive that provides electrical conductivity at low dosages not achievable with any standard conductive additive. These low dosages enable the electrical resistivity of the material to be reduced with minimal impact on the host matrix, including retaining and even improving mechanical properties, minimally increasing density, and limiting the influence on the rheological properties and colour.

TUBALL™ MATRIX 602 is a concentrate specifically designed to provide superior electrical conductivity to silicone compounds (LSR — liquid silicone rubber, RTV — room temperature vulcanised rubber, HCR — high consistency rubber) while retaining mechanical properties and minimally impacting the host matrix.

BENEFITS

- TUBALL™ SWCNT, carried by TUBALL™ MATRIX, enable ultra-low dosage of conductive filler starting from just 0.03 wt.% for **anti-static, static dissipative and conductive applications**
- Allow production of conductive parts that retains **bright colours**
- Ensure permanent and uniform **electrical conductivity without “hot spots”**
- **Maintain rheology** of the uncured compound
- **Standard processing** and mixing equipment
- Improve mechanical properties and retain softness

TYPICAL PROPERTIES

Property	Test method	Value
Concentrate carrier	–	Vinyl-terminated polydimethylsiloxane
Colour and appearance	–	Black paste
Density at 25°C	DIN 51757	Approx. 1.02 g/cm ³
Vinyl groups	–	0.36 mmol/g

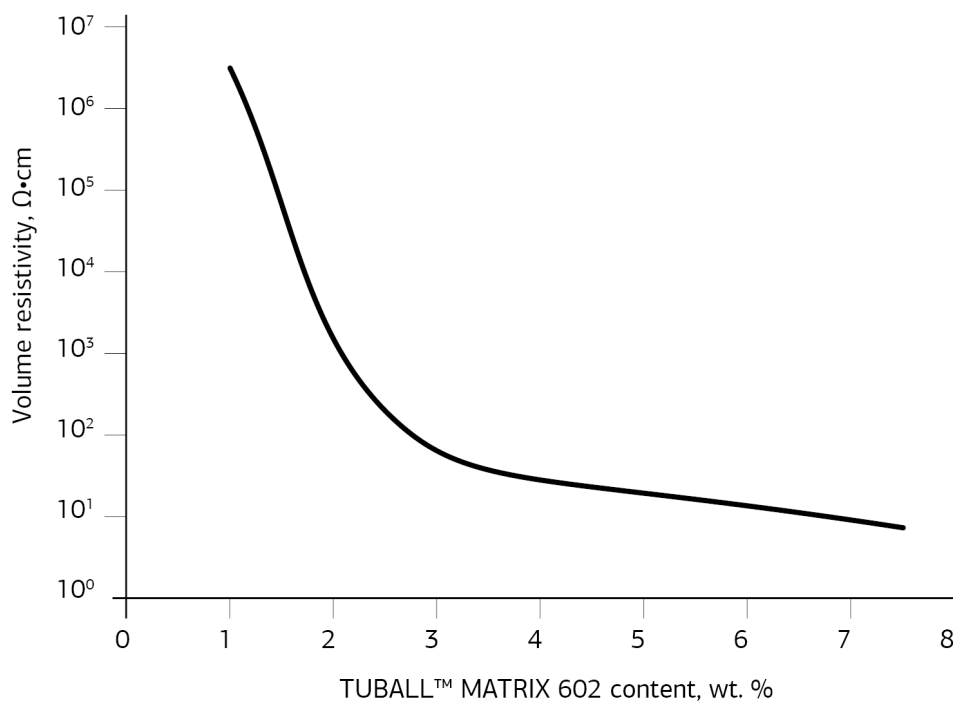
TYPICAL DOSAGE LEVEL

The concentration of **TUBALL™ MATRIX 602** that is required in the final compound should be determined according to the desired level of conductivity, as shown in Figure 1 for HCR and in Figure 2 for LSR and RTV.

The loading required to obtain a specific conductivity can vary by type of silicone, by the final formulation and by the type of application. The dosage rates in Figure 1 and Figure 2 are based on tests carried out by OCSiAl in 2016, exact concentration depends on the viscosity of basic material, parameters of equipment, etc..

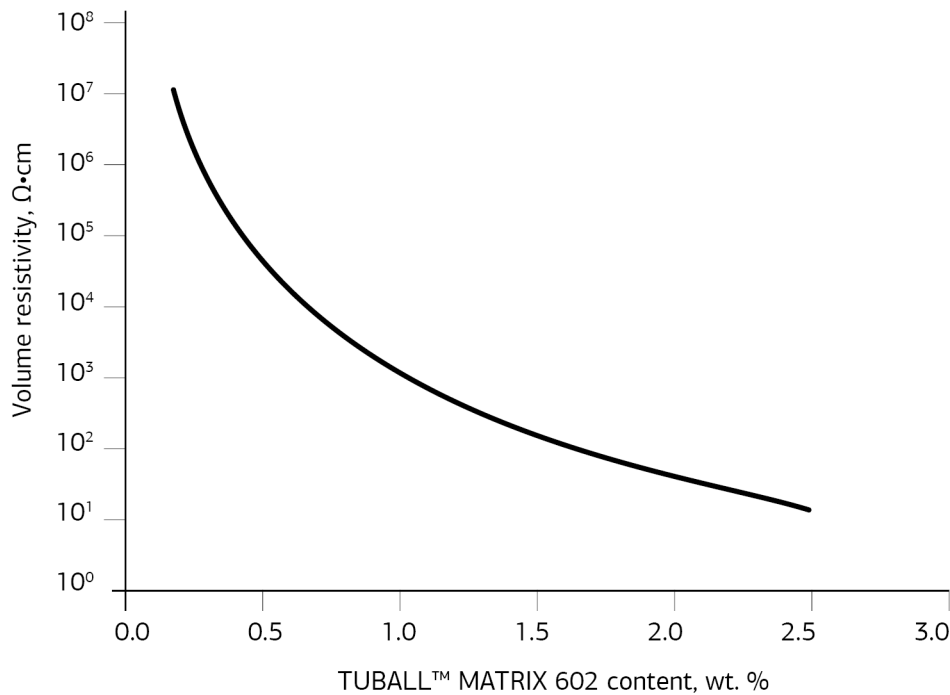
It is also important to note that the required dosage level of **TUBALL™ MATRIX** refers to the whole system. For example, if the system consists of 50% part A and 50% part B, and the required level of volume resistivity in liquid silicone is 10³ Ω·cm, the required **TUBALL™ MATRIX** concentration should be 1 wt.% for the whole system and 2 wt.% for part A (**Figure 2**).

Figure 1. Volume resistivity of HCR with **TUBALL™ MATRIX 602** is in the range 10⁷–10 Ω·cm*



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

Figure 2. Volume resistivity of RTV with **TUBALL™ MATRIX 602** is in the range 10⁷–10¹ Ω·cm*



*Tested in two-component RTV (basic viscosity 25 000 mPa.s), dilution in part A.
Measurements conducted according to ASTM D991 standard.

METHOD OF ADDITION

To enable the development of a well-distributed network of percolating TUBALL™ nanotubes in the silicone matrix, a compounding step of the concentrate is essential.

TUBALL™ MATRIX 602 can be diluted into compounds through the use of standard silicone compounding equipment. Other approaches for masterbatch dilution may be used provided that their mixing efficiency is sufficient. More information about the key parameters for masterbatch dilution and compound processing can be found in the “Dilution Guidelines for TUBALL™ MATRIX 601/602 for Liquid Silicones” and “Dilution Guidelines for TUBALL™ MATRIX 602/605 for High Consistency Silicones”.

PACKAGING

Plastic or metal cans (0.2, 0.5, 1, 5, 10 kg).

OCSiAl provides TUBALL™ MATRIX 602 test samples in metal cans (50, 100 or 200 g concentrate).

STORAGE AND TRANSPORTATION

The product is stable in its unopened original packaging when stored under normal temperature conditions. The recommended storage life is up to 24 months when stored as directed.

SAFETY

To ensure safe handling, the appropriate safety regulations should be observed. OCSiAl recommends that every user should be able to apply the safe handling procedures necessary for the user’s applications before any handling or manufacturing takes place. A Safety Data Sheet outlining the hazards and handling methods for TUBALL™ MATRIX is available.

WARRANTIES AND DISCLAIMER

The Products correspond to the chemical composition indicated in the Technical Data Sheet and the 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.

CONTACT INFORMATION

ASIA		EUROPE	NORTH & SOUTH AMERICA
<p>KOREA Office 208, Pilot Plant Bldg. 12, Gaetbeol-ro, Yeonsu-gu, Incheon 406-840 Republic of Korea +82 50 8113 6959 asiapacific@ocsial.com</p>	<p>CHINA #2004, 20th Floor, Block B, Dachong Business Centre, No. 9678, Shennan Road, Nanshan District, Shenzhen, Guangdong, China +86 135 90125295</p>	<p>LUXEMBOURG 1 Rue de la Poudrerie L-3364 LEUDELANGE Grand-Duche de Luxembourg +352 27990373 europe@ocsial.com</p>	<p>USA 500 S Front Str., Suite 860, Columbus, OH 43215 +1 415 906 5271 usa@ocsial.com</p>
<p>HONG KONG Room 1102, 11/F, Lippo Sun Plaza, 28 Canton Road, Tsim Sha Tsui, Kowloon, Hong Kong +852 21627385</p>	<p>Room B8, Naked Hub, Building 1, No. 818, Shenchang Road, Minhang District, Shanghai, China china@ocsial.com</p>	<p>RUSSIA 29, bld. 2, Kalanchevskaya Str., Moscow, 107078 +7 499 653 5152</p> <p>24, Inzhenernaya Str., Novosibirsk 630090, Russia +7 383 201 8387 russia@ocsial.com</p>	
<p>JAPAN Kusumoto Chemicals Ltd. Kusumoto Bldg. 1-11-13 Uchikanda Chiyoda-ku, Tokyo, Japan, 1010047 +81 03 32928685 info_tuball@kusumoto.co.jp</p>			