

TECHNICAL DATA SHEET

MASTERBATCH FOR EPDM

GENERAL INFORMATION

The performance of TUBALL™ graphene nanotubes (GNTs) in rubbers is based on creating an additional 3D network, embedded in the rubber matrix. Even low dosages have the effect of toughening the polymer, improving fatigue properties, reducing aging losses, and adding electrical conductivity.

TUBALL™ MATRIX 610 for rubber products is a versatile masterbatch designed to enhance the physical and mechanical properties of rubbers and to contribute to required electrical conductivity properties.

The versatility of the product lies in its potential to be utilized in blends of other rubber and filler products without having to adjust the formulation or technological process.

TUBALL™ MATRIX 610 is an industrial modifier based on TUBALL™ GNTs and a blend of polymer and paraffin oil, and is specifically designed for EPDM rubber compounds.

Compatibility — EPDM and other polymers relatively compatible with butadiene copolymers.

BENEFITS

- TUBALL™ GNTs, carried by TUBALL™ MATRIX, enable ultra-low dosage starting from just 3 wt.% for anti-static applications based on mineral fillers;
- Improves complex of mechanical properties such as tensile modulus and tear strength by up to 70%;
- Retains colors, no carbon release to surface;
- Permanent, uniform electrical conductivity;
- Carrier compatible with a wide range of Mooney grades formulations and fillers;
- Maintains rheology;
- Standard processing and mixing equipment;
- Maintains softness and elastic properties.

TYPICAL PROPERTIES

| PROPERTY | VALUE |
|----------------------|---|
| Concentrate carrier | Severely refined paraffinic mineral oils, polymer |
| Color and appearance | Black paste |
| Density | 0.88–0.89 g/cm ³ |

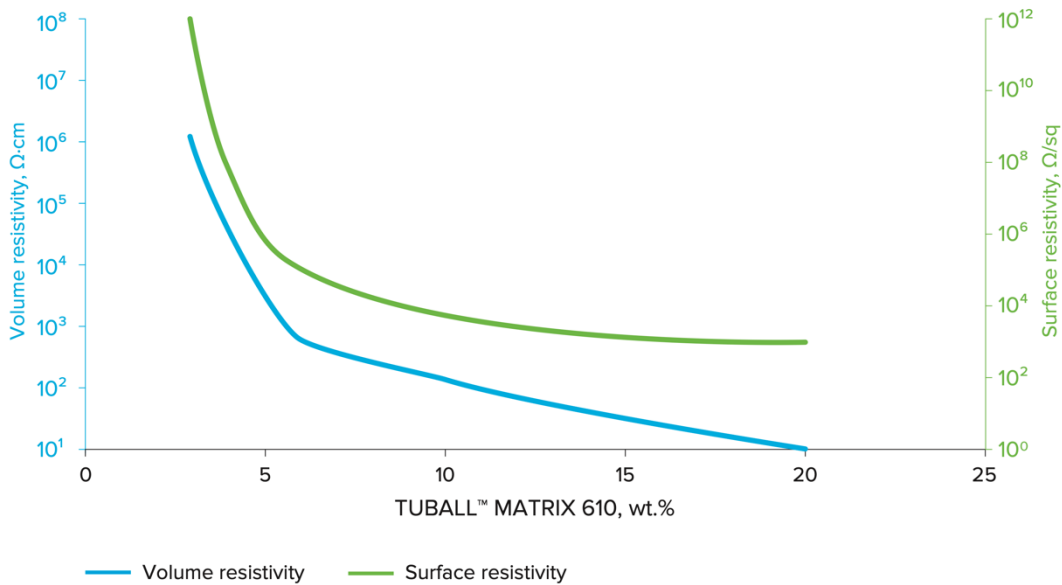
TYPICAL DOSAGE LEVEL

The concentration of TUBALL™ MATRIX 610 that is required in the final compound should be determined according to the desired level of resistivity, as shown in Figure 1.

The masterbatch loading required to obtain a specific resistivity can vary by type of EPDM, the final formulation (filler, plasticizer), compounding process, etc.

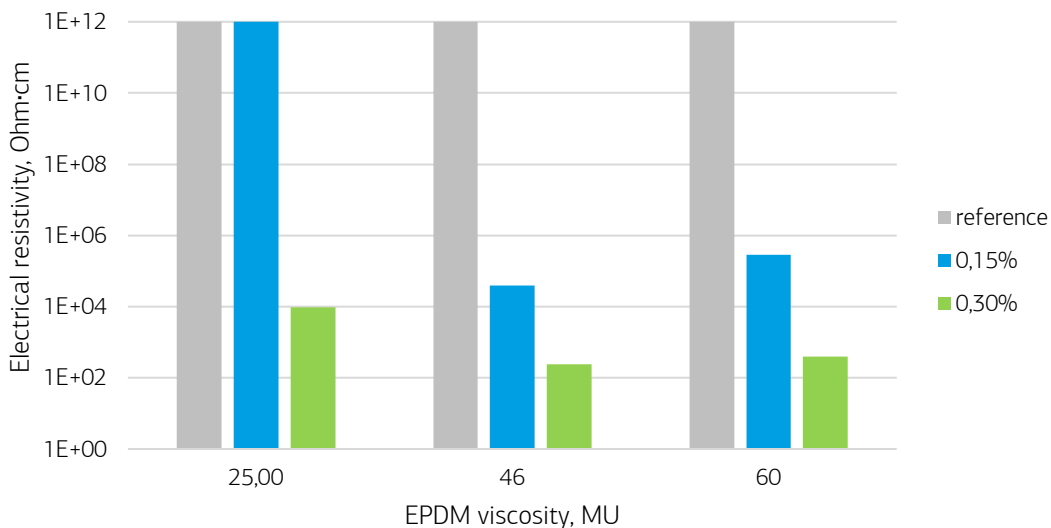
For initial evaluation of TUBALL™ MATRIX 610 it is recommended to test several dosages starting from 3 wt.%, then for example 4 and 6 wt.% to determine the optimum dosage.

Figure 1. Electrical resistivity data.*



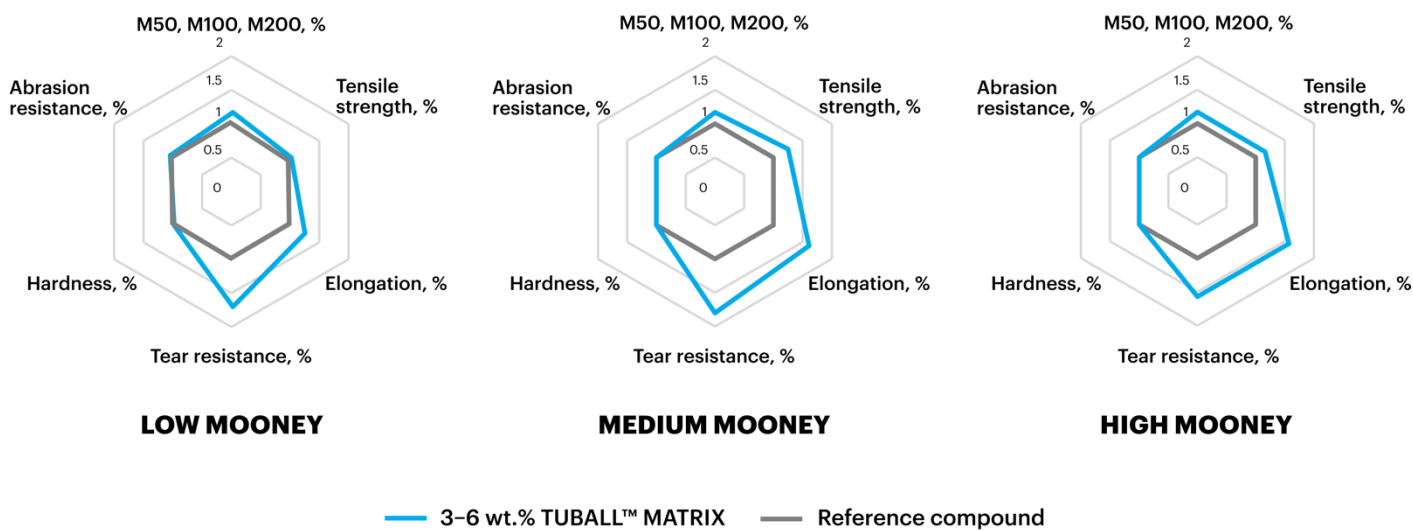
* ASTM D 991 – Volume resistivity; 2-probe handheld device (SIMCO ST-4) – Surface resistivity.

Figure 2. Electrical resistivity* as a function EPDM viscosity.



* ASTM D 991 – Volume resistivity.

Figure 3. Impact to mechanical properties as a function of EPDM viscosity with 3 and 6 wt.% of TUBALL™ MATRIX 610 (TUBALL™ 0.15, 0.3 wt.%).



- M50, M100, M200 increased by 15–20%
- Tensile strength increased by 16–25%

- Tear resistance increased by 25–103%
- Abrasion resistance increased by 3–11%

- No drawback in elasticity
- Electrical resistivity 10^6 – $10^9 \Omega$ -cm

For more information, refer to validation reports.

METHOD OF ADDITION

The optimal mixing option is a combination of an internal mixer and several passes in a 2-roll mill.

For more information, refer to Processing guidelines.

VULCANISATION

No specific requirements.

PACKAGING

Plastic containers (0.1, 0.2, 0.5, 1, 5, 10 kg).

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 12 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.

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