TUBALL™ MATRIX

PROCESSING GUIDELINES

for **TUBALL™ MATRIX 610**
for anti-static colored EPDM compounds (peroxide and sulfur curing systems)

RECOMMENDATIONS ON USE OF TUBALL™ MATRIX 610

MIXING EQUIPMENT

Figure 1. Internal mixer

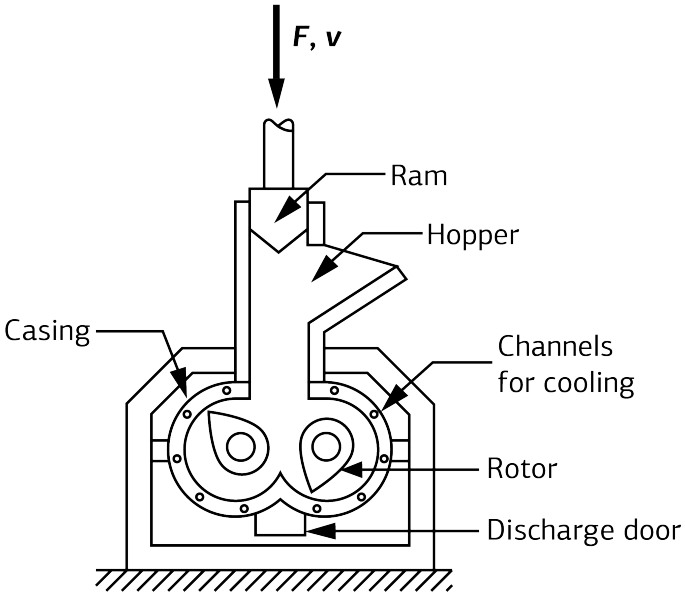
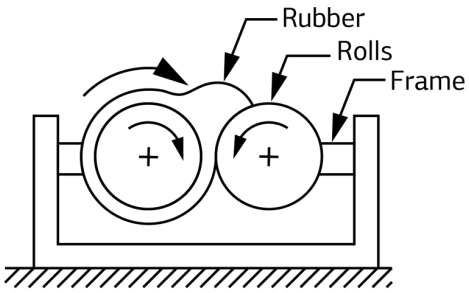


Figure 2. 2-roll mill



DILUTION PRINCIPLES

Recommended dosage

For initial evaluation of **TUBALL™ MATRIX 610** it is recommended to test several dosages such as 3, 4 and 6 wt.% to determine the optimum dosage.

Examples of two basic formulation types (peroxide & sulfur curing) with calculation of the concentration of **TUBALL™ MATRIX** in a rubber compound are shown below.

Compound	Peroxide curing system			Sulfur curing system		
	Reference, phr	With TUBALL™, phr		Reference, phr	With TUBALL™, phr	
TUBALL™ MATRIX contents, wt.%	**-**	**3**	**6**	**-**	**3**	**6**
EPDM	100	100	100	100	100	100
TUBALL™ MATRIX 610	–	5.9	12	–	5.4	11.1
Plasticizer (Paraffinic oil)	5	5	5	5	5	5
PEG 4000	2	2	2	–	–	–
CaCO3	10	10	10	–	–	–
Silica	43	43	43	50	50	50
Clay	10	10	10	–	–	–
TiO_2	5	5	5	5	5	5
ZnO	3	3	3	5	5	5
TAIC	8	8	8	–	–	–
Peroxide (BIPB-40-GR)	3	3	3	–	–	–
Stearic acid	–	–	–	1	1	1

Si 69	–	–	–	5	5	5
Sulfur	–	–	–	1.5	1.5	1.5
MBT	–	–	–	0.5	0.5	0.5
TMTD	–	–	–	1	1	1
Total	**189**	**194.9**	**201**	**174**	**179.4**	**185.1**

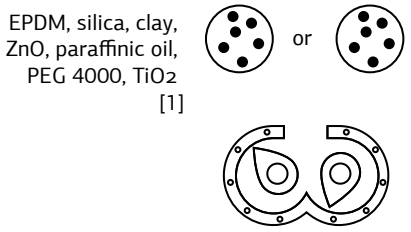
It is recommended that laboratory tests be carried out to study the effect of **TUBALL™ MATRIX** concentration on the properties of samples in order to optimize the formula used. The most efficient working concentration of **TUBALL™ MATRIX** must be determined experimentally at the production facility, as it depends on the intended use of the prepared rubber mixture and on the process.

COMPOUNDING

OPTION 1 (TUBALL™ MATRIX 610 addition in EPDM-based compound using internal mixer)

Two-stage mixing process for rubber preparation by internal mixer rotor type Intermix (SKI-3L rotors speed 50 rpm) and 2-roll rubber mill, roll diameter 200 mm, length 400 mm, friction 1:1.2 are used. Add **TUBALL™ MATRIX 610** at the second mixing stage at the same time as other ingredients. The compounding process for two curing systems is shown below.

Introduction of TUBALL™ MATRIX



STAGE 1: COMPOUND PREBLENDING (internal mixer)

Put ingredients into mixing chamber (Peroxide curing system [1], Sulfur curing system [2]) (0.5 min)

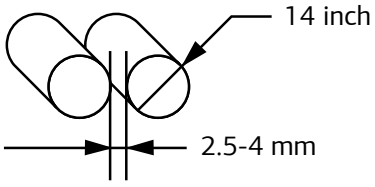
Mixing (3 min)

Sweep ram (3.5 min)

Dump butch, after 5 minutes of mixing or after reaching a temperature of 150 °C (5 min).

Total time 12 minutes

temp. 50±5 °C

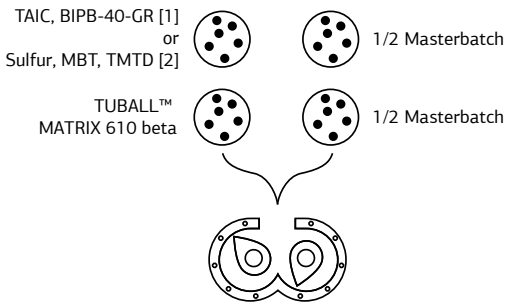


Band and cross-blend (2-roll mill)

Pass compound through 2-roll mill

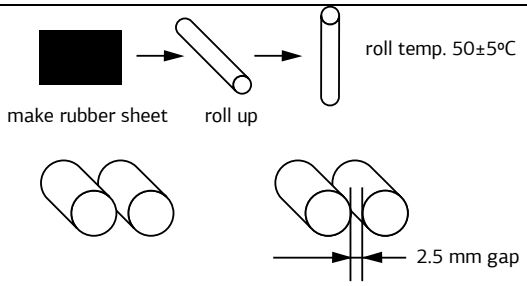
After first stage, compound should be stored from 1 to 24 hours under normal conditions.

After thermostating process, second mixing stage is performed



STAGE 2: MATRIX introduction stage (Internal mixer)

- 1/2 Masterbatch from stage 1
- Add ingredients (Peroxide curing system [1], Sulfur curing system [2])
- Add TUBALL™ MATRIX 610
- 1/2 Masterbatch from stage 1

	Total time 0,5 minutes Dump butch after 2 minutes of mixing or after reaching a temperature of 100 °C for peroxide curing system or 80 °C for sulfur curing system (2 min).
	**Band and cross-blend (2-roll mill)** Pass compound through 2-roll mill and form into a tube. Heat to 90 °C and repeat 6 times. After mixing, compound should be stored from 1 to 24 hours under normal conditions.

Curing conditions

The following curing parameters were used (may vary based on your MDR results):

Curing system	Curing sample dimensions, mm	Pressure, kgf/cm^2	Temperature, °C	Time, min
Peroxide	145×145×2	200	180	20
Sulfur			160	40

OPTION 2 (TUBALL™ MATRIX 610 addition in EPDM-based compound using 2-roll rubber mill)

Compounding process

1st Stage. Initial compound prepared through internal mixer rotor type – Intermix (SKI-3L rotors speed 50 rpm). Refer to Option 1 Stages 1-2.

2nd Stage. TUBALL™ MATRIX 610 and curing agents were added at the second mixing stage using 2-roll rubber mill.

Batch weight 1,000 g.

NOTE: batch weight can be adjusted according to 2-roll mill used.

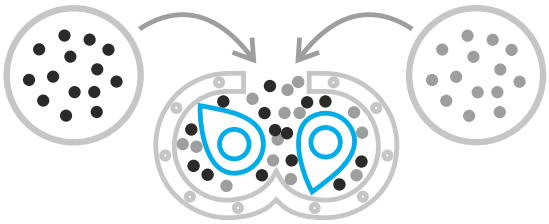
MIXING PROCEDURE

Equipment — Internal mixer — 2-roll mill (Roll diameter – 200 mm, friction – 1:1.1, rolls speed – 22.7:25, roll temperature: 50+5 °C)

Stage 1

COMPOUND PREPARATION
Internal mixer

Required amount of EPDM

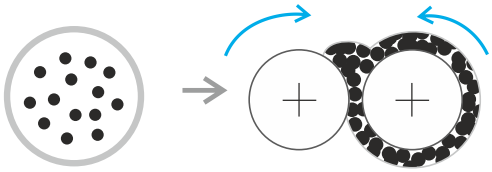


Chemicals except curing agent and TUBALL™ MATRIX

Stage 2

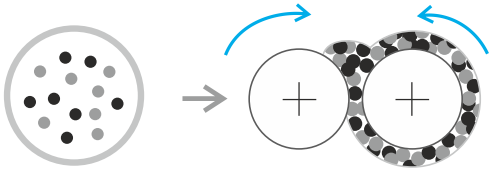
COMPOUNDING WITH TUBALL™ MATRIX
2-roll mill

2.1. EPDM from stage 1



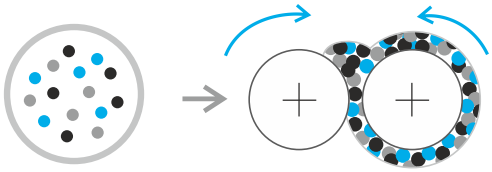
Gap size — 0.5 mm
Mixing time — 2 min

2.2. Add curing agent



Mix until homogeneous
Mixing time — 3 min

2.3. Add TUBALL™ MATRIX 610

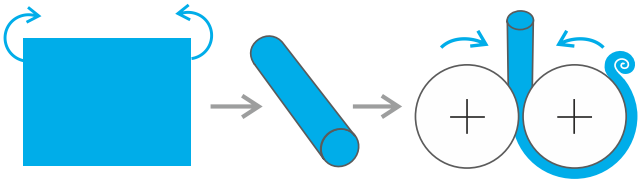


Mix until homogeneous
Mixing time — 5 min
Increase gap to 2 mm

Decrease rolls speed to take off the mixture

Stage 3

"ROLL AND UPEND" MIXING
2-roll mill



Gap size — 0.5 mm
10 cycles
Increase gap to 2—2.5 mm

Continue rolling the compound to reach ~2 mm thickness
Make sheet and conditioning before curing for 1 to 24 hours under normal conditions

Stage 4

CURING

CURING SYSTEM	CURING SAMPLE DIMENSIONS, mm	PRESSURE, kgf/cm²	TEMPERATURE, °C	TIME, min
Peroxide	145x145x2	200	180	20
Sulfur			160	40

May vary based on your MDR results and formulation

Stage 5

ELECTRICAL RESISTIVITY MEASUREMENT

Surface resistivity – ASTM D 257

Volume resistivity – ASTM D 991

Determination of performance from TUBALL™ MATRIX

The complex of rubber properties may be determined according to the following international standards:
ASTM D 412 – Strength indices;
ASTM D 2240 – Shore A Hardness;
ASTM D 395 – Compression set;
ASTM D 257, D 991 – Electrical resistance;
ASTM D 5289 – Rheometric data;
ASTM D 5963 – Abrasion indices;
ASTM D 624 – Tear Strength, etc.

If there are special requirements for the rubber, or other operational needs, other tests as defined by the user may need to be conducted.

NOTE

Adjustment of oil/plastisizer content in formulation

The total plasticizer content will be increased with **TUBALL™ MATRIX** addition compared to the reference compound. Depending on the dosage of **TUBALL™ MATRIX,** plasticizer content may be adjusted in order to avoid a significant impact on viscosity and stiffness and to optimize the final properties.

Electrical resistivity measurements

It is recommended to follow international standards for measurement of electrical properties in the laboratory and for molded parts. Non-standard methods and the accuracy of the handheld devices and surface quality of samples can affect the data.

OCSiAl supports customers to obtain qualified electrical resistivity measurements. To perform the correct measurements, please refer to the Electrical resistivity guidelines on our YouTube channel.

Alternatively, contact our regional offices and technical support centers to receive a copy of the guidelines or request measurements of your samples.