



Recommendations

MagPro[®] for technical rubber products

Description and application

The product under the trademarks MagPro® 150 and MagPro® 170 is high surface area magnesium oxide obtained by indirect calcination of milled natural magnesium hydroxide.

MagPro® is a white powder containing approx. 95% of magnesium oxide. Specific surface area is quite high: 150 m²/g for the MagPro® 150 and 170 m²/g for the MagPro® 170. It has a stable particle size distribution.

MagPro® is used as an effective acid acceptor, scorch controller, curing agent and heat stabilizer in the production of rubber technical products based on halogenated rubbers:

- Polychloroprene (CR).
- Nitrile butadiene rubber mixed with polychloroprene (NBR + CR).
- Fluoroelastomers (FKM).
- Chlorinated polyethylene (CPE).
- Chlorosulfonated polyethylene (CSM).
- Hydrogenated Nitrile rubber (HNBR).
- Epichlorohydrin rubber (ECO).
- EPDM mixed with polychloroprene (EPDM+CR).



How does MagPro[®] work?

MgO is typically added in the above rubbers at 0.5–4 phr (special cases up to 10 phr) or at about 0.2% of the total compounding batch weight.

As a conclusion, MgO is typically compounded in rubbers that contain halogen (-Cl, -Br, -F) or nitrogen-carbon bonds (e.g., nitrile). A vulcanization activator is also present in all rubber compounds - usually zinc oxide. Irrespectively of the complexity of the corresponding action mechanisms, usually MgO's role is fulfilled upon reaction with acids and/or their corresponding metal salts:



где X = -Cl, -Br, -F, -CN

ZnX₂ is very strong Lewis acid; it acts as a crosslinking catalyst facilitating the formation of C-C between different chains (crosslinking) at increased temperatures.

Whatever the case is, the formation of ZnX_2 is hindered by the presence of MgO either during mixing or during crosslinking, dampening in this way the overall curing rate resulting in greater processing stability.

For being used in manufacturing of rubber cables, MgO must have a high surface activity, preferably a specific surface area greater than $130 \text{ m}^2/\text{g}$. The higher the value, the higher the safety of processing and the properties of the vulcanizate.

The time before vulcanization begins is directly related to the activity of magnesium oxide in the rubber formulation, the larger the surface area of magnesium oxide, the longer it is for the same formulation. As an approximate guideline, the faster vulcanization occurs, the higher MgO activity should be used.



Application

Table 1. Chloroprene rubbers (CR). Technical rubber products (injection moulding)

Function	Ingredients	Tradename	Dosage,phr
Rubber	Sulphur modified rubber (G)	Neopren GRT	100.0
Acid acceptor	High active MgO	MagPro® 150	4.0
Curing agent	Zinc Oxide	ZnO	5.0
Scorch retarder	MBTS	Vulkacit DM	0.5
Antioxidant	Octylated DiPhenylAmine (ODPA)	Vulkanox OCD	1.0
Antiozonant	Mix diaryl para-phenylene diamine with waxes	Akrochem MPD-100	2.0
Reinforcing fillers	Carbon black, precipitated silica, china clay	Carbon black N772, N774 or N660	25.0
Plasticizers	Aromatic or naphthenic oils, polyesters, chlorinated waxes	DINP, DODP, TOTM	8.0
Processing Aids	Stearic acid, waxes, LMWPE	Stearic acid	0.5
Total			146.0

Typical formulations for the manufacturing of technical rubber products based on halogenated rubbers are presented onwards.

Curing conditions: 15 min. at 153°C.

Typical properties:

- Tensile Strength 20–25 MPa.
- Elongation 500–700%.
- Hardness 65 Shore A.

Application

Table 2. Fluoroelastomers (FKM). Extrusion compound — Bisphenol Cure

Function	Ingredients	Tradename	Dosage,phr
Rubber	Fluoroelastomer (FKM type)	DuPont Viton A	100.0
Reinforcing fillers	Carbon black, precipitated silica	Carbon black N990	30.0
Acid acceptor	High active MgO	MagPro® 150	3.0
Acid acceptor	Calcium Hydroxide	Ca(OH) ₂	6.0
Curing agent	Hindered phenols	Bisphenol AF	1.8
Curing accelerator	Benzyltriphenylphosphonium chloride (BTPPC)	BTPPC	0.6
Total			141.4

Curing conditions: 10 min. at 177°C.

Typical properties:

- Tensile Strength 10,7 MPa.
- Elongation 295 %.
- Hardness 76 Shore A.

Application

Table 3. Chlorinated PE (CPE). Molded goods compound — Amine curing

Function	Ingredients	Tradename	Dosage,phr
Rubber	Chlorinated PE Rubber	TYRIN CM 0136	100.0
Acid acceptor	High active MgO	MagPro® 150	5.0
Reinforcing fillers	Carbon black	N550	50.0
Filler	Precipitated silica	Ultrasil VN3	10.0
Plasticizers	Aromatic or naphthenic oils	DINP, DODP, TOTM	35.0
Curing agent	Dimercapto Thiadiazole	VANAX 189	3.0
Curing accelerator	Amine accelerator	Hexamethylene Tetramine (HMT)	1.0
Antioxidant	Styrenated diphenylamines	SDPA	1.0
Antioxidant/ metal deactivator	Hindered phenolic antioxidant/ metal deactivator	Lowinox MD24	1.0
Total			206.0

Curing conditions: 20 min. at 160°C.

Typical properties:

- Tensile Strength 18 MPa.
- Elongation 530%.
- Hardness 78 Shore A.

Application

Table 4. Chlorosulfonated PE (CSM). Molded goods compound — Sulfur-bearing curing

Function	Ingredients	Tradename	Dosage,phr
Rubber	CSM Rubber	Hypalon 40	100.0
Reinforcing filler	Carbon black, precipitated silica, china clay	Carbon black N762	60.0
Plasticizers	Aromatic or naphthenic oils	DINP, DODP, TOTM	25.0
Processing aids	Microcrystalline waxes, LMWPE, paraffin waxes	Struktol PEH-100	2.0
Acid acceptor, curing agent	High active MgO	MagPro® 150	5.0
Curing accelerator	Primary polyols	Pentaerythritol	3.0
Curing accelerator, curing co-agent	Dipentamethylene thiuram tetrasulfide	Tetrone A	2.0
Scorch retarder	MBTS	Vulkacit DM	0.5
		Total	197.5

Curing conditions: 20 min. at 160°C.

Typical properties:

- Tensile Strength 21 MPa.
- Elongation 290 %.
- Hardness 70 Shore A.

Application

Table 5. Hydrogenated Nitrile Butadiene rubber (HNBR). Molded goods compound — Peroxide curing

Function	Ingredients	Tradename	Dosage,phr
Rubber	HNBR Rubber	ZETPOL	100.0
Curing activator	Zinc Oxide	ZnO	2.0
Acid acceptor,	High active MgO	MagPro® 150	1.5
curing agent	Styrenated diphenylamines	SDPA	1.0
Antioxidant	Benzimidazole	Vulkanox ZMB2	0.4
Antioxidant	Carbon black, precipitated silica, china clay	Carbon black N990	100.0
Reinforcing filler	Cresyl diphenyl phosphate	Disflamoll DPK	10.0
Plasticizer, FR	Bis-maleimide	HVA-2	1.5
Curing co-agent	Dicumyl peroxide, 40 %	Vulcup 40KE	7.5
Curing agent			223.9

Curing conditions: 17 min. at 170°C.

Typical properties:

- Tensile Strength 17 MPa.
- Elongation 325 %.
- Hardness 72 Shore A.

MagPro[®] advantages for manufacturing of technical rubber products

- Effective acid scavenger, scorch controller, curing agent and heat stabilizer for halogen containing rubber compounds.
- Does not contain critical impurities — sulfates and chlorides.
- Precise and stable particle size distribution.
- Easy substitution in the formulations — MagPro[®] is replaced in a ratio of 1:1 by weight with the previously used type of active magnesium oxide.
- The best price/surface area ratio in the market.
- Wide range of packaging solutions (1 MT big-bags, 20 kg PE bags, pre-weighted 1 kg low melt EVA sachets).
- Safe in transportation, storage, production.
- Stable quality.

By choosing MagPro® products you ensure best technical support for application of product and receive a possibility to develop a custom solution with individual properties.

Please contact us via request form.



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