PEÑOLES

Hidromag Q SERIES

PRECIPITATED MAGNESIUM HYDROXIDE

For TPO Roofing Membranes

QUIMICA DEL REY

Helping to Create Safer Environments

Quimica del Rey Plant is located in the town of Laguna del Rey, Municipality of Sierra Mojada, in the Western part of the State of Coahuila, México.

Product and Company Profile

Hidromag is a 99% purity Synthetic Magnesium Hydroxide, produced by Química del Rey which is one of the leading manufacturers of Magnesium Products in the world and is part of the Industrias Peñoles Metallurgical-Chemical Group.

Química del Rey was established in 1964, developing the major chemical plant within Peñoles group. Peñoles's shares have traded on Mexican Stock Exchange since 1968 under the ticker PE&OLES.

As a primary raw material, the production of Hidromag requires a purified Magnesium Chloride brine, obtained from the geological genesis of an underground salted lake, in the Coahuila desert formed some 65 million years ago. The deposit consists of a solid mineral phase and a liquid phase. As a secondary feedstock for the precipitation of the MDH, Peñoles uses high purity Dolomite, extracted from its Esmeralda Mine, at projected production rates. The proved reserves of the deposit, allow us to continue production beyond the next 400 years.

Quimica del Rey is manufacturing flame retardant MDH (Hidromag) in a specifically designed state-of-the-art plant, which started to operate in mid 2008. Modern equipment and a well-trained staff ensure the supply of a product with premium quality and high consistency.

The particular dedication to the control of the precipitation process leads to a high purity product above 99%. Multiple purification steps remove impurities from the crystal surface. Most of the remaining constituents are part of the crystal lattice and do not migrate in a plastic compound.

Our philosophy is to build close partnership with our customers, supporting them to develop innovative products to stand out on the markets.

VISION

To be the most recognized Mexican company in its sector worldwide, for its global focus, the quality of its processes, the excellence of its people and the ethical leading of its business.

MISSION

To add value to non-renewable natural resources in a sustainable manner.

Hidromag Q SERIES

HALOGEN FREE FLAME RETARDANT

For TPO Roofing Membranes

The Thermoplastic Olefins (TPO) "cool roof" single-ply roofing membranes show a remarkable growth rate among commercial roof construction products not only in the North-American but also in the European markets.

TPO membranes gained wide acceptance for their excellent weathering performance, installation advantages, reflective properties and overall economic feasibility. TPO membranes are environmental friendly and are made without plasticizers and chlorinated compounds, therefore Magnesium Hydroxide as additive flame retardant is part of the system.

ADVANTAGES OF TPO SINGLE-PLY ROOFING MEMBRANES

- Cleaner Surface
- Long-Term Energy Efficiency
- Greater Weather Resistance
- Excellent Heat & UV Resistance
- Improved Long-Term Performance

Hidromag HQ3005 and HQ1005, produced by Química del Rey are high purity synthetic Magnesium Hydroxide (MDH). Both Hidromag grades are surface modified MDH particularly designed for roofing application.

Hidromag Q SERIES

PRECIPITATED MAGNESIUM HYDROXIDE

Magnesium hydroxide is a functional mineral filler used in the manufacture of halogen-free thermoplastic and thermosetting compounds to achieve good fireproofing characteristics, with flame resistance properties, low smoke emission and non-corrosive gases.

These compounds generally have higher content of mineral filler, and this addition may arise some difficulties during the manufacturing process, due to the incompatibility of the mineral filler with the polymer matrix.

To solve this issue, Química del Rey has developed by own propietary technology a series of Synthetic Magnesium Hydroxides denominated "Hidromag Q".

Hidromag HQ3005 and HQ1005 are Magnesium Hydroxide grades with a surface coated with a fatty acid to facilitate the incorporation of the mineral filler into the polymer matrix.

Hidromag Q is offered in 2 grades with different particle size distribution (PSD)
Hidromag HQ3005 & Hidromag HQ1005

Chemical Properties

Typical Values

		Units	Hidromag HQ3005 / HQ1005
Chemical Composition	CaO	%	0.36
	Chloride	%	0.15
	Fe_2O_3	%	0.03
	Al_2O_3	%	0.06
	SiO_2	%	0.08
Free Moisture (105°C)		%	<0.3
Surface treatment		%	0.9 – 1.1
		Additive	Fatty Acids

Physical Properties

Typical Values

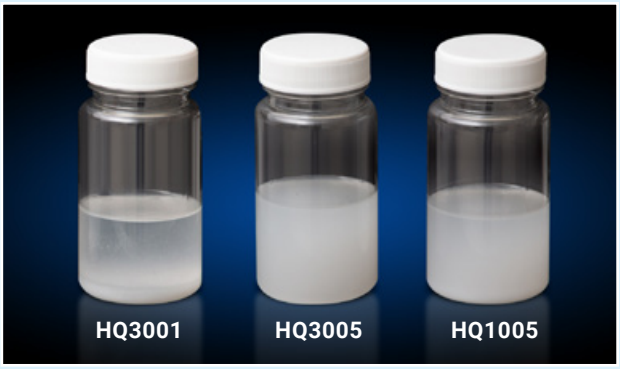
		Units	Hidromag HQ3005	Hidromag HQ1005
Specific Surface Area (BET)	-	m^2/g	5.0—6.0	7.0—8.0
Particle Size Distribution	d10	µm	0.1—0.5	0.1—0.5
	d50	µm	3.5—5.0	1.7—2.5
	d90	µm	8.0—11.0	6.0—9.0
Specific Density	-	g/cm^3	2.38	2.38
Bulk Density	-	g/cm^3	0.48	0.40
Whiteness	Tappi	%	95	95

Hidromag Q SERIES

PRECIPITATED MAGNESIUM HYDROXIDE

Improves wettability of mineral filler

Wettability test of MDH-HQs samples in liquid paraffin evaluates the compatibility in a non-polar organic medium. High level of turbidity or no noticeable sedimentation indicates a better affinity of the mineral filler into a non-polar liquid.

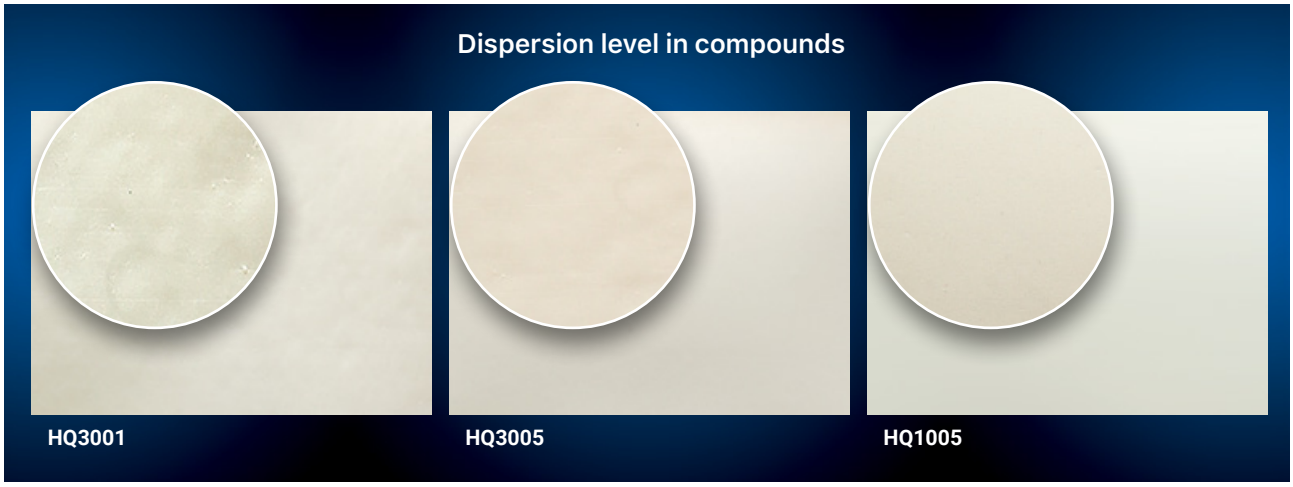


Dispersion of Hidromag in liquid paraffin

Hidromag HQ3001 particles without surface treatment have a more visible sedimentation indicating low compatibility with the medium. On the other hand, the surface-treated samples of HQ3005 and HQ1005 remain dispersed homogeneously after 2 hours, showing that particles of coated MDH-HQ were better affinity with the liquid paraffin.

In practical applications that means that the surface treatment helps to improve the interaction between the MDH particles and a non-polar medium, similar to the polymers used.

Improves interaction Polymer/MDH particles of compounds



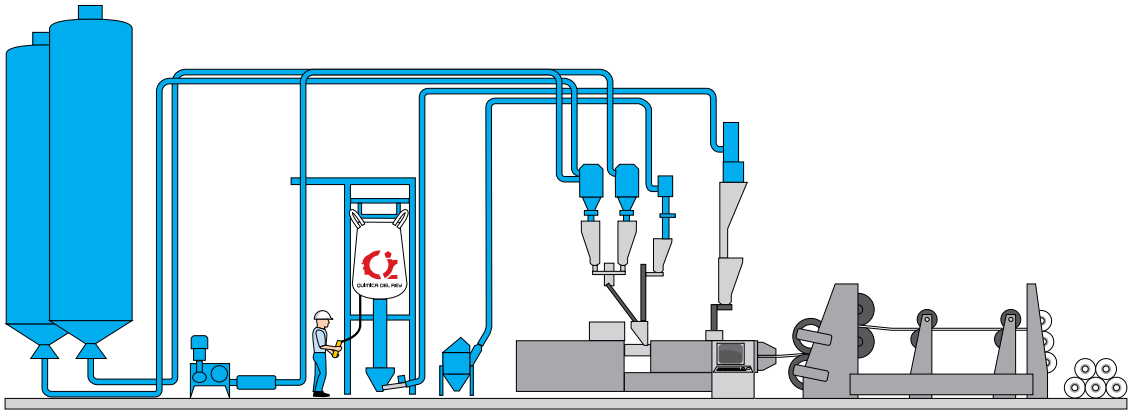
Using Magnesium Hydroxide with surface treatment contributed to improve the interaction of the mineral filler into the polymer matrix, enhancing a higher level of dispersion during the processing compound, which is reflected in a smoother membrane surface.

In consequence stability process and output in the manufacturing line of the compounds are improved.

Improves processing and Performance properties

Hidromag Q SERIES

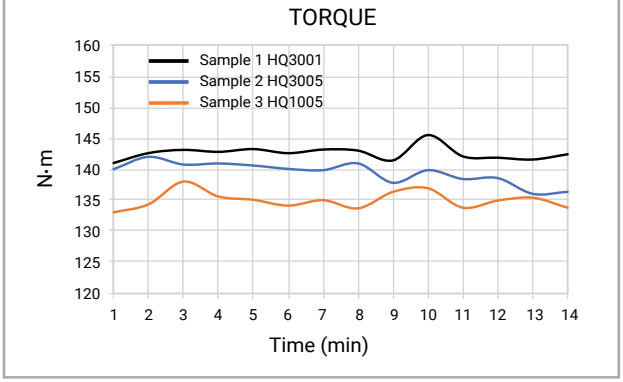
HALOGEN FREE FLAME RETARDANT

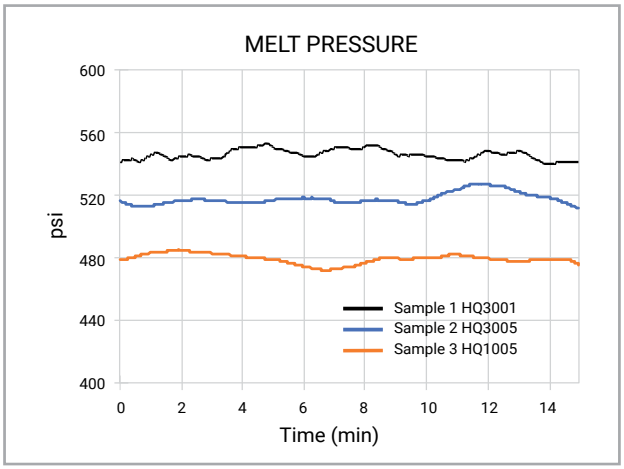


Typical composition of TPO Roofing

Materials	Sample 1 HQ3001 Wt%	Sample 2 HQ3005 Wt%	Sample3 HQ1005 Wt%
PP	21.3	21.3	21.3
LDPE	42.5	42.5	42.5
Antioxidant	0.2	0.2	0.2
UV Stabilizers	1.0	1.0	1.0
MDH HQ3001*	35.0	-	-
MDH HQ3005	-	35.0	-
MDH HQ1005	-	-	35.0
Total	**100.0**	**100.0**	**100.0**

* Hidromag HQ3001: MDH without surface treatment (d50: 3.5—5.0 µm)





The surface treatment of Hidromag Q products helps to improve the rheological and mechanical properties.

The analysis of the melt pressure and torque allow us to evaluate the effect of Hidromag HQ's influences on the final quality product.

The HQ's treated (HQ3005 and HQ1005) decrease the melt pressure and torque in comparison with untreated HQ3001, being more evident with the product HQ1005 which has a smaller particle size (d50).

The same positive effect is observed in mechanical and rheological properties.

Performance Properties

Sample Compound	Maximum Tensile Strength (MPa)	Elongation at Break (%)	MFI 190°C 2.16KG g/10min	Density g/cm³
Sample 1 HQ3001	12.3	721	2.3	1.16
Sample 2 HQ3005	14.0	807	2.8	1.15
Sample 3 HQ1005	15.2	836	2.8	1.15

Performance and Flame Retardant Properties

"Fire Performance" is used to define the capacity of non-flammable material in front to action of fire, this is a property required in construction sector and describes the ability of a material to contribute the spread of fire.

Fire Performance Evaluation Cone Calorimeter Test Acording to ISO 5660	Sample 1 HQ3001	Sample 2 HQ3005	Sample 3 HQ1005
Ignition Time (sec)	46.00	40.00	40.00
Peak HHR kW/m²	507	497	459
Total Heat Release (MJ/m²)	119	114	116
Total Smoke Release (m²/m²)	1426	1268	1253
MARHE (kW/m²)	328.7	338.8	330.3

The results demonstrate that surface treatment does not affect negatively the behaviour of compounds in a fire scenery.

Flexible and Fire Performing Waterproofing Membranes

Materials	phr
Polypropylene ICPP (Polypropylene Impact Copolymer)	15—25
VERSIFYTM Propylene Based Elastomer INFUSE TM Olefinic Block Copolymer	75—85
Hidromag HQ3005 (Magnesium Hydroxide)	60—140
Irganox B225 (Primary/Secondary Antioxidant)	0.2—0.4
Chimassorb 2020 (Hindered Amine Light Stabilizer)	0.5—1
Kronos 2220 (Titanium Dioxide)	3—5

System Tests According to Standard ENV1187

The fire behaviour of roofing membranes is segmented into different classes according to standard EN13501-5.

This application requires a system tests described in ENV1187, namely B_{roof} t1, t2 y t3.

Test Set-Up	Test Sample	Results Classification
Test 1 According to ENV 1187 t1	1.5mm thickness Polyester scrim Polymers PP& Dow Elastomers filled with 30-40% Hidromag HQ3005	√ B_{roof} (t1)
Test 2 According to ENV 1187 t2	1.5mm thickness Polyester scrim Polymers PP& Dow Elastomers filled with 50-60% Hidromag HQ3005	√ B_{roof} (t2)
Test 3 According to ENV 1187 t3	1.5mm thickness Polyester scrim Polymers PP& Dow Elastomers filled with 45-55% Hidromag HQ3005	√ B_{roof} (t3)

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Certificate of Registration

LUCIDEON

This is to certify that the Quality Management System of

Química del Rey, S.A de C.V

Production Plant: Laguna del Rey, Ocampo Coahuila, Mexico. C.P. 27600
Dolomita Mine: Esmeralda, Sierra Mojada, Coahuila, Mexico. C.P. 27610
Sales Offices: Torreon, Coahuila, Mexico. C.P. 27268 & Mexico City, C.P. 11250
Supplies Office: Torreon, Coahuila, Mexico. C.P. 27268

Meets the requirements of

ISO 9001:2015

Scope of Registration

Manufacture and Supply of Magnesium Sulphate, Sodium Sulphate, Refractory and Chemical Grade Magnesium Oxide and Magnesium Hydroxide Specialities.

Signed for and on behalf of Lucideon CICS Limited

Authorised Signatory

Certificate No: 23460 Date of Issue: 29 June 2018
Issue No: 1.29 June 2018 Date of Expiry: 28 June 2021

Certification to a Quality Management System has been maintained since 1994.
The use of the Accreditation Mark indicates accreditation in respect of those activities covered by the accreditation certificate no.0008

This Certificate of Registration is granted subject to conformance with the conditions of contract governing its registration.
Further clarification regarding this certificate may be obtained by contacting the organization.

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Responsibility / Reliability