

APPLIED MINERALS

DRAGONITE™

Enhancing Polyolefin Productivity



Natural Additive for Cycle Time Reduction

Overview

DRAGONITE is a halloysite clay-based additive commercially proven and patented to provide unmatched cycle time reduction in polyolefins through a combination of nucleation, reinforcement, and rheological properties. Applied Minerals offers Dragonite-HP™ in powder and masterbatch form.

Contact:

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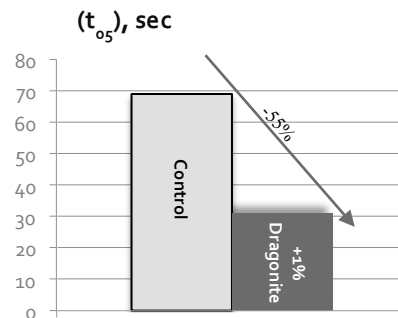
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Key Advantages:

Reduced Cycle Time in:

- Polyethylene by up to 30%
- Polypropylene by up to 25%
- Low loadings required (1.0%)
- Energy consumption reduction
- All natural mineral
- FDA approved for food packaging

Crystallization Half-Time

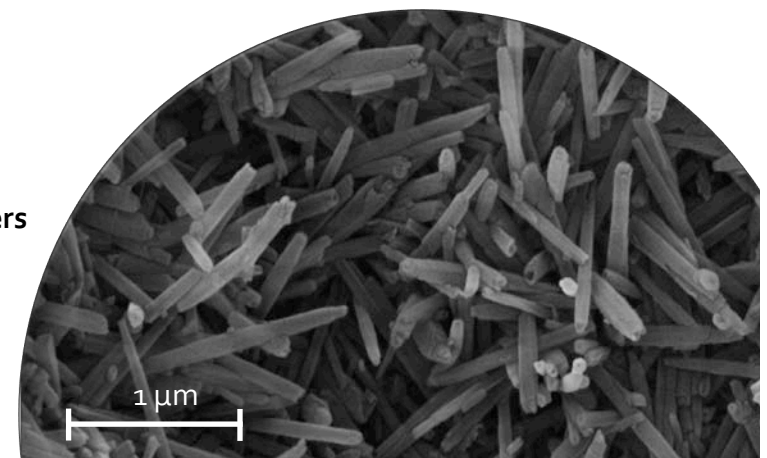


Additional Benefits Reported By Customers

- Modulus and strength increased
- Dimensional stability improved
- Thin-walling ability
- Surface finish improved
- Notched impact toughness maintained

Cycle Time Reduction in Multiple Molding Processes @ 1% Dragonite Loading

Customer Trial	Resin	Cycle Time Reduction	Molding Process
#1	HDPE	25%	Injection Blow
	PP Copolymer	22%	
#2	HDPE	20%	Injection Blow
	HDPE	16%	
#3	HDPE	15%	Injection Rotational
	HDPE	16%	
#4	HDPE	16%	Injection
	HDPE (33% CaCO ₃)		



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Recommended Grades

DRAGONITE-HP

Untreated product grade with high reactivity and pH of 4-5.

Recommended loading rate: 1.0%

DRAGONITE-HP:A

Ammoniated product grade with low reactivity and pH neutral. Ideal for applications where acidity has the ability to negatively affect the polymer network.

Recommended loading rate: 1.0%

Key Properties

Property	Value
Chemical Formula	$Al_2Si_2O_5(OH)_4 \cdot 2H_2O$
Chemistry	Al_2O_3 37.7% SiO_2 43.4%
Length	0.2-2.0 μm
Outside Diameter	50-70 nm
Inside Diameter	15-30 nm
Aspect Ratio (L/D)	10-20
Particle Size (d_{90})	< 10 μm
Particle Size (d_{50})	< 0.2 μm
BET Surface Area	65 $m^2 g^{-1}$
True Specific Gravity	2.53 $g cm^{-3}$
Bulk Density	~ 16 lb/ft^3
BET Pore Volume	20 - 25%
Oil (Linseed) Absorption	40 lbs / 100 lbs
Cation Exchange Capacity	11 meq / 100g

Injection Molding

	Virgin HDPE	HDPE + 1% Dragonite HP	Savings
Cycle time per part (sec)	107	80	25%
Parts per hour	34	45	32%
Cost per part (\$)	\$8.07	\$7.53	7%
Net Effective Cost of HDPE (\$/lb)	\$0.85	\$0.76	11%

With a 1 wt% Dragonite-HP loading, the customer achieved:

- 25% reduction in cycle time resulting in significant manufacturing cost reduction
- Improved strength and modulus over the control
- Eliminated sink marks while also improving surface appearance



Rotational Molding

Objective:

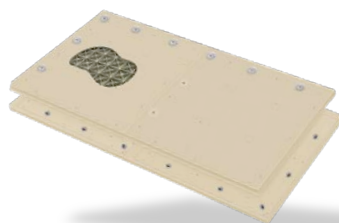
- To reduce cycle time and reduce weight of rotational molded part

Solution:

- 15% cycle time reduction with just 1.0% loading of Dragonite-HP
- 16% weight reduction of the part by thin walling due to the increased strength
- Fixed part defects



Compression Molding



Heavy-Duty Large Mat & Temporary Roadway System (HDPE)

Objective:

- Reduce coefficient of thermal expansion (CTE) and increase strength without affecting impact resistance
- Reduce warpage as interlocking parts require tight tolerances

Solution:

- CTE reduced with just 1.0% loading of Dragonite-HP
- Substantial cycle time reduction
- Improved strength and stiffness give the opportunity for thin-walling to reduce weight in next generation product