Product Information
Plastics

DOW CORNING

Dow Corning® Si Powder Resin Modifiers

FEATURES & BENEFITS

- Halogen-free
- Free-flowing powder
- Low use levels

In highly filled systems:

- Reduces torque
- Reduces die drool
- Can increase LOI and reduce heat release rate, smoke, and carbon monoxide evolution
- Improves Scratch and Mar
- Maintains/ Improves impact and tensile strength performance
- Reduces water absorption in highly filled systems
- High heat stability

COMPOSITION

- Halogen-free, Si powder, 100% actives

Halogen-free, powdered siloxane

APPLICATIONS

- Plastics additive

TYPICAL PROPERTIES

Specification Writers: These values are not intended for use in preparing specifications. Please contact your local Dow Corning sales office or your Global Dow Corning Connection before writing specifications on this product.

Property	Result
Form	Powder
Color	White to off-white
Organic Reactivity	
Dow Corning® 4-7105 Resin Modifier	None
Dow Corning® 4-7081 Resin Modifier	Methacrylate

INTRODUCTION

Dow Corning® Si Powder Resin Modifiers are halogen-free powdered siloxanes recommended as processing aids in highly filled thermoplastic formulations such as halogen free flame-retardant wire and cable, window profiles, pipes, etc. Benefits observed include reduced die drool and torque, increased/maintained impact and tensile strength, lower water absorption, improved scratch and mar, higher LOI, and lower heat release rate, smoke, and rate of toxic gas evolution.

DESCRIPTION

Dow Corning Si Powder Resin Modifiers are 100% active, halogen-free, siloxane powders. They are available with either methacrylate functionality or no additional organo-reactivity. The organic reactivity controls the compatibility, and, often, the performance of *Dow Corning* Si Powder Resin Modifiers in selected plastic applications. A comparison between 4-7081 Resin Modifier and competitive materials can be seen in Table 1.

BENEFITS

At levels of 2% or less, *Dow Corning* Si Powder Resin Modifiers can act as a processing aid, improving the processing of thermoplastics, giving reduced extruder torque and thus, reduced power consumption. In highly filled halogen-free FR thermoplastic formulations, *Dow Corning* Si Powder Resin Modifiers not only act to reduce torque, but also reduce die drool, thereby allowing increases in through-put and on-line time. They also reduce water absorption, which can be very beneficial in applications such as wire and cable. Additional benefits may result via a necessary reduction in solid FR additives.

In a highly filled (65%) ATH wire and cable formulation (see Formulation 1), we observed with addition of 4% Dow Corning 4-7081 Resin Modifier:

- 11% torque reduction
- 29% water absorption reduction
- Significant die drool reduction (see photos on next page)

Levels of 1 to 8% *Dow Corning* Si Powder Resin Modifiers can modify the burning characteristics of thermo-plastics, reducing the rate of heat

Table 1:

Property / Product	Die Drool Reduction ?	Torque (% Δ)	Tensile Strength at Break (% Δ)	Tensile Elongation (% Δ)	Limited Oxygen Index (% Δ)	H2O Absorption Reduction (1 month) (% Δ)	Cost in Use (% Δ)
4% 4-7081 Resin Modifier	**Excellent**	**-11%**	**No Change**	**-3%**	**+9%**	**-30%**	Base Case
4% C1- (Si based)	Good	-19%	-19%	-46%	+5%	-23%	0%
2% C2- (Si based)	Excellent	-17%	-9%	-21%	-11%	+23%	0%
4% C3- (Organic)	Poor	-12%	-25%	+6%	-3%	-16%	33% Lower
1% C4- (Fluoro based)	Poor	-8%	-2%	-31%	-2%	-23%	33% Higher

Control: 61% ATH, 0% *Dow Corning* 4-7081 Resin Modifier

With 4% *Dow Corning* 4-7081 Resin Modifier, 57% ATH

Formulation 1: Wire and Cable Formulation

Component	Wt %	Description
EVA	24.3-27.5	*ExxonMobil*®[1] *1002.09*
LLDPE	6-6.8	*ExxonMobil* LD761.36
Antioxidant	0.20	*Irganox*®[2] B225
Coupling Agent	0.60	XIAMETER® OFS-6011 Silane
Flame Retardant: Untreated ATH	65	*Martinal*®[3] OL 104LEO
Processing Aid/Flame Retardant	4	*Dow Corning* 4-7081 Resin Modifier
Processing Aid	4	Competitor #1 (Si Based)
Processing Aid	2	Competitor #2 (Si Based)
Processing Aid	4	Competitor #3 (Organic)
Processing Aid	1	Competitor #4 (F Based)

[1] Registered trademark of Exxon Corporation.
[2] Registered trademark of CIBA Specialty Chemicals Corporation.
[3] Registered trademark of Martinswerk GmbH.

release and the rate of smoke and carbon monoxide evolution. Similar burning characteristic modifications have been observed in halogen-free, halogenated and phosphorus FR systems. See Tables 2, 3 and 4 and Figure 1 for comparative performance data.

Dow Corning Si Powder Resin Modifiers can help improve mechanical properties of highly filled resin systems. Levels of 3 to 5% can help restore impact strength that is lost when FR fillers are added (see Figure 2); and tensile strength can be maintained with the addition level of 4% 4-7081, as is the case with the Wire and Cable formulation.

HOW TO USE

Dow Corning Si Powder Resin Modifiers and thermoplastic pellets are pre-mixed at a ratio to give the desired siloxane level in the final product. If powdered FR additives are in the compound, it may be desirable to mix

the siloxane powder with the powdered FR additives. Processing is handled the same as is normally done for the thermoplastic alone. Often, easier processing, lower extruder torque, and faster throughput are observed.

HANDLING PRECAUTIONS

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND MATERIAL SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE MATERIAL SAFETY DATA SHEET IS AVAILABLE ON THE DOW CORNING WEBSITE AT DOW CORNING.COM, OR FROM YOUR DOW CORNING SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CORNING CUSTOMER SERVICE.

USABLE LIFE AND STORAGE

When stored at or below 60 ℃ (140 ℉) in the original unopened containers, *Dow Corning* Si Powder Resin Modifiers have a usable life of 24 months from the date of manufacture.

PACKAGING

This product is available in a variety of container sizes. Contact your local Dow Corning sales representative for information about container sizes available in your area.

LIMITATIONS

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

Table 2: Cone Calorimeter Data for Silicone-Modified Plastics (Q_{ext} = 30 kW/m^2)

Material	% Heat Release Rate vs. Control	% Carbon Monoxide Rate vs. Control	% Smoke Rate vs. Control
Polycarbonate (Dow Chemical)	100	100	100
99% PC, 1% *Dow Corning* 4-7081 Resin Modifier	57.17	40.86	38.39
95% PC, 5% *Dow Corning* 4-7081 Resin Modifier	40.38	23.26	44.34
Polypropylene (Exxon)	100	100	100
99% PP, 1% *Dow Corning* 4-7081 Resin Modifier	100.0	89.6	85.48
95% PP, 5% *Dow Corning* 4-7081 Resin Modifier	55.4	39.6	77.4
92% PP, 8% *Dow Corning* 4-7081 Resin Modifier	53.5	31.8	67.7
EVA 20% VA 100% (Exxon)	100	100	100
99% EVA, 1% *Dow Corning* 4-7081 Resin Modifier	66	51	77.3
97% EVA, 3% *Dow Corning* 4-7081 Resin Modifier	54	44.9	72.7
95% EVA, 5% *Dow Corning* 4-7081 Resin Modifier	49	42.8	72.7

Table 3: Polypropylene Modified with *Dow Corning* 4-7081 Resin Modifier and $Mg(OH)_2$: Heat Release Rate, Carbon Monoxide Evolution and Impact Strength

Material, Weight %	Peak Heat Release Rate, % vs. control	Peak CO Evolution Rate, % vs. control	Notched Izod Impact, ft-lb/inch
Polypropylene *Esocrene*®[1] 1012	100	100	0.821
95% PP/5% *Dow Corning* 4-7081 Resin Modifier	55.4	39.6	0.675
75% PP/25% $Mg(OH)_2$ *Versamag*®[2] UF	32.5	23.4	0.389
75% PP/20% $Mg(OH)_2$/5% *Dow Corning* 4-7081 Resin Modifier	26.9	20.0	0.737

[1] Registered trademark of Exxon Corporation.
[2] Registered trademark of Martin Marietta Magnesia Specialties.

HEALTH AND ENVIRONMENTAL INFORMATION

To support customers in their product safety needs, Dow Corning has an extensive Product Stewardship organization and a team of Product Safety and Regulatory Compliance (PS&RC) specialists available in each area.

For further information, please see our website, dowcorning.com, or consult your local Dow Corning representative.

LIMITED WARRANTY INFORMATION – PLEASE READ CAREFULLY

The information contained herein is offered in good faith and is believed to be accurate. However, because conditions and methods of use of our products are beyond our control, this information should not be used in substitution for customer's tests to ensure that our products are safe, effective, and fully satisfactory for the intended end use. Suggestions of use shall not be taken as inducements to infringe any patent.

Dow Corning's sole warranty is that our products will meet the sales specifications in effect at the time of shipment.

Your exclusive remedy for breach of such warranty is limited to refund of purchase price or replacement of any product shown to be other than as warranted.

Table 4: Cone Calorimeter, Processing and Impact Properties of Polypropylene Modified with Ammonium Polyphosphate Flame Retardants, with and without *Dow Corning* 4-7081 Resin Modifier

Material, Weight %	Peak Heat Release Rate, % vs. Control	Peak CO Evolution Rate, % vs. Control	Peak Smoke Evolution Rate, % vs. Control	Torque, % vs. Control
Polypropylene *Esocrene*®[1] 1012 (Control)	100	100	100	N/A
99% PP, 1% *Dow Corning* 4-7081 Resin Modifier	100.0	89.6	85.48	N/A
95% PP, 5% *Dow Corning* 4-7081 Resin Modifier	55.4	39.6	77.4	N/A
70% PP, 30% *Exolit*®[2] AP 422 (Control)	62.5	51.1	87.4	100[4]
69% PP, 30% *Exolit* AP 422, 1% *Dow Corning* 4-7081 Resin Modifier	N/A	N/A	N/A	46.4[5]
85% PP,15% *Exolit* AP 422	68.3	65.5	92.8	55.8[4]
82% PP, 15% *Exolit* AP 422, 3% *Dow Corning* 4-7081 Resin Modifier	48.7	61.0	107.0	N/A[5]
70% PP, 30% *Phos-Chek*®[3] P40 (Control)	68.1	56.9	90.8	100[6]
80% PP, 15% *Phos-Chek* P40, 5% *Dow Corning* 4-7081 Resin Modifier	37.5	47.4	86.7	64.2[5]

[1] Registered trademark of Martin Marietta Magnesia Specialties.
[2] Registered trademark of Clariant Gmb.
[3] Registered trademark of ICL Performance Products.
[4] Some buildup on screws by phosphorus FR additive.
[5] No buildup on screws.
[6] Major buildup on screws by phosphorus FR additive.
N/A – Not available or not applicable.

Figure 1: Heat Emission of Polystyrene Modified with *Dow Corning* 4-7081 Resin Modifier

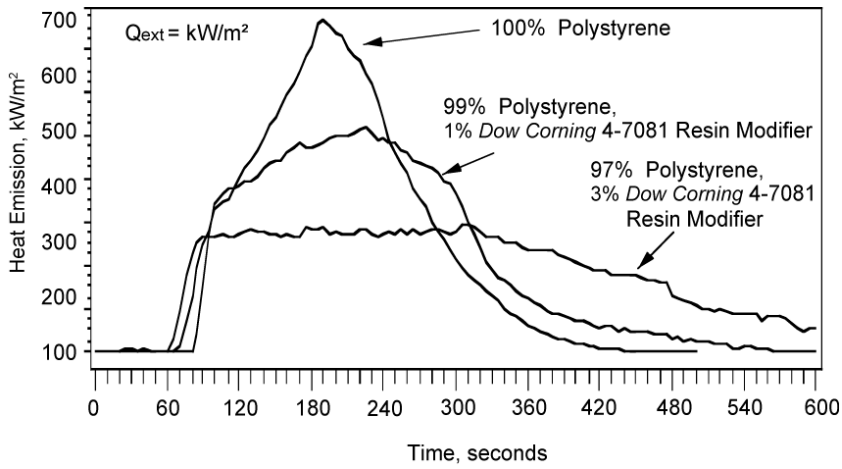

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Figure 2: Notched Izod Impact – Effect of *Dow Corning* 4-7081 Resin Modifier on PP + $Mg(OH)_2$