Javachem®

Silicone Additives for LSZH Flame-retardant Cable Compounds

Synergistic flame retardancy Promoted puller speed improved die drool better surface

Javachem®GT for LSZH Flame-Retardant Cable Compounds

Javachem®GT are functional masterbatches of special modified UHMW siloxane polymer, which can improve processing and application performances of LSZH cable compounds, with features of good dispersion, convenient usage, safety and environmental protection.

Javachem®GT for LSZH Flame-Retardant Cable Compounds

Excellent processing performance

Improve melt fluidity, reduce energy consumption and enhance production efficiency

Promote dispersion of inorganic flame retardants

Reduce die drool and promote line speed

Application performance

Decrease surface energy, enhance gloss and smoothness of product surface

Synergistic effect with inorganic flame retardants and improve flame-retardant performance

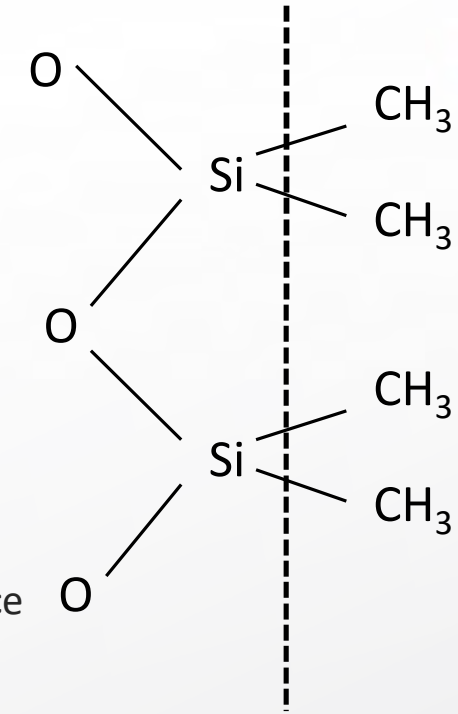
Reduce COF, improve scratch and abrasion resistance

No exudation and stickiness, no influence on printing

“DNA” of Silicone

Polar inorganic backbone

- Long bond length and large bond energy of Si-O
  - Si-O (0.183nm, 460kj/mol)
  - C-C (0.153nm, 332kj/mol)
- Large bond angle of Si-O-Si
  - Si-O-Si 144°
  - C-C-C 109°
- Small rotation steric hindrance of O-Si-O
  - Low internal rotation energy
  - Low intermolecular force

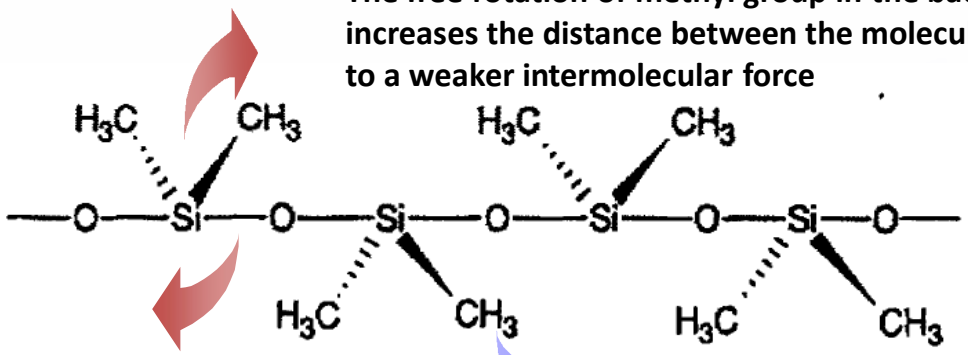


Non-polar organic substituent

- Methyl—low steric hindrance
  Free conformation movement of methyl group around the backbone
- Weak intermolecular force
- Hydrophobicity
- Can be replaced by other functional groups

Structure Determines Property

The free rotation of methyl group in the backbone increases the distance between the molecules, leading to a weaker intermolecular force



The required energy for the rotation of Si-O is almost zero, making the backbone flexible

The aligned structure of methyl makes its almost encapsulation of Si-O chains

1.Flexible Si-O backbone, low intermolecular force → Easy to diffusive flow, easy film-forming, improve fluidity and promote puller speed

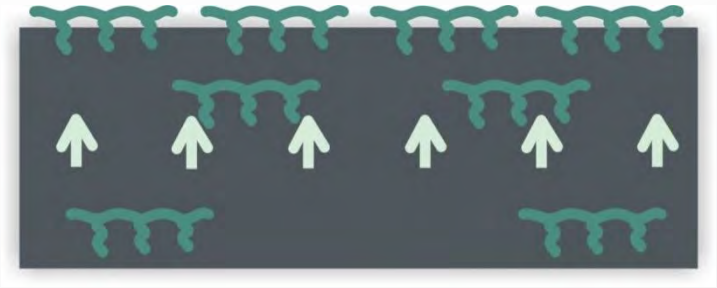
2. Low surface energy, have good affinity with metal, forming silicone lubricant layer on metal surface → Reduce COF, improve product efficiency and have a smooth surface

3. Backbone of high bond energy, silicone of product surface can form similar-glass layer. → Enhance thermal aging performance, synergistic flame retardancy

Javachem®GT for LSZH Flame-Retardant Cable Compounds

The incorporated functional groups act as anchoring effect in polyolefin resin, so Javachem®GT can be easier to evenly enrich on the material surface.

With functional groups, evenly enrich on the material surface



Javachem®GT

In melting process, Javachem®GT migrate to the material surface and form a dynamic lubricant layer on the interface between melt and machine. Meanwhile, due to the entanglement of UHMW macromolecular and anchoring effect of functional groups, it imparts the material surface with gloss and excellent touch feel without exudation and stickiness.

Javachem®GT for LSZH Flame-Retardant Cable Compounds

Product name	Carrier	Effective component	Content（%）	Dosage（%）	Features
Javachem®GT-150P	LLDPE	Siloxane polymer	45	1.0-5	Processing stability and die-drool reduction
Javachem®GT-300	LLDPE	Siloxane polymer	55	0.5-5	Melt flowability and reduced torque
Javachem®GT-600	LLDPE	Siloxane polymer	60	0.5-5	Scratch & abrasion resistance
Javachem®GW-6200P	Silica	Siloxane polymer	75	0.2-2	Comprehensive improvement on processing and surface properties

Javachem®GT for LSZH Flame-Retardant Cable Compounds

Basic formulation

Material	Blank	Contrast sample
EVA/LLDPE	31.5	30
$Al(OH)_3$	60	60
PE-g-MAH	6	6
Antioxidant	0.5	0.5
Black masterbatch	2	2
Javachem®GT	-	1.5

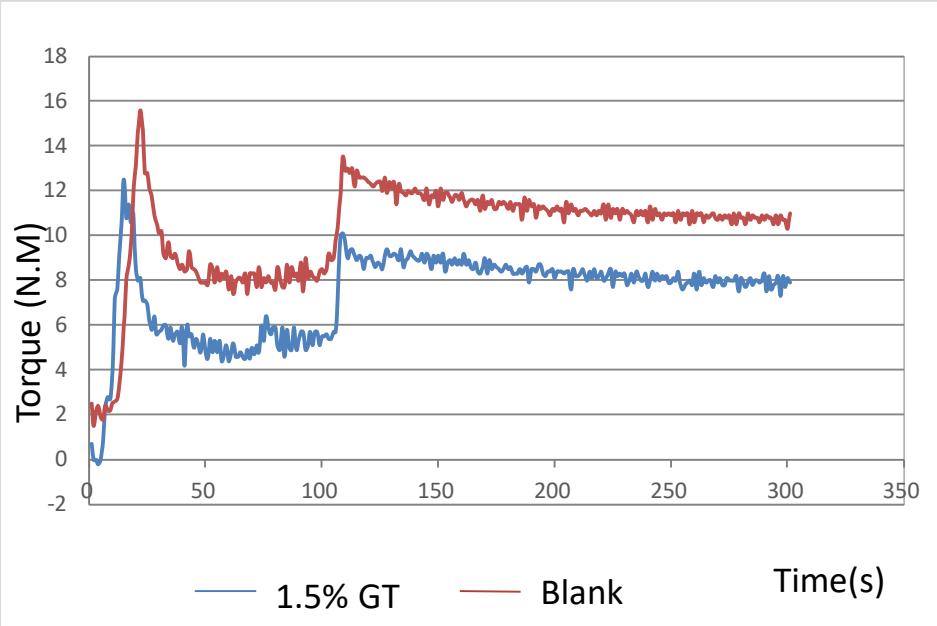
Testing Standard

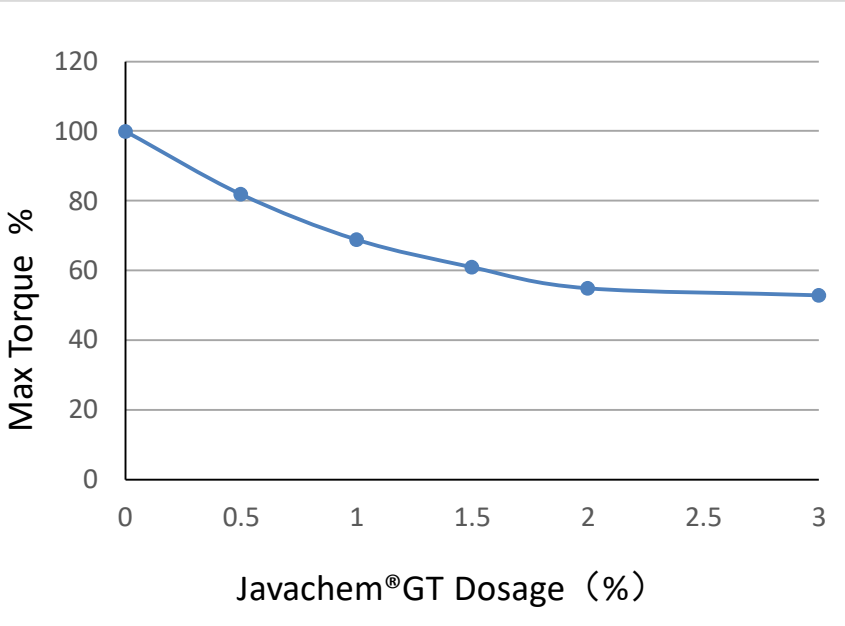
Test item	Test equipment	Test standard
Density	Density Balance	GB/T 1033.1
MFR	MTS ZRZ1452	GB/T 3682-2000
Rheological performance	HAPRO Torque Rheometer RM-200A	--
Tensile strength	MTS Universal Testing Machine CMT4204	GB/T 1040-2006
Elongation at break	MTS Universal Testing Machine CMT4204	GB/T 1040-2006
Oxygen index	MOTIS Oxygen Index Instrument	GB/T 2406
Volume resistivity	Ultra-high Resistance Tester EST121	GB/T 1410

Test Results

	Blank	1.0%	1.5%	2.0%
Density（g/cm^3）	1.45	1.45	1.45	1.45
MFR（g/10min）	11.55	12.07	12.71	13.34
Balanced torque(N·m)	11.6	10.2	8.1	7.8
Tensile strength（MPa）	12.3	13.1	13.6	14.1
Elongation at break（%）	165	172	181	184
Oxygen index（%）	36.2	37.1	37.8	38.5
Volume resistivity（Ω·cm）	2.2×10^{14}	2.5×10^{14}	2.5×10^{14}	2.8×10^{14}

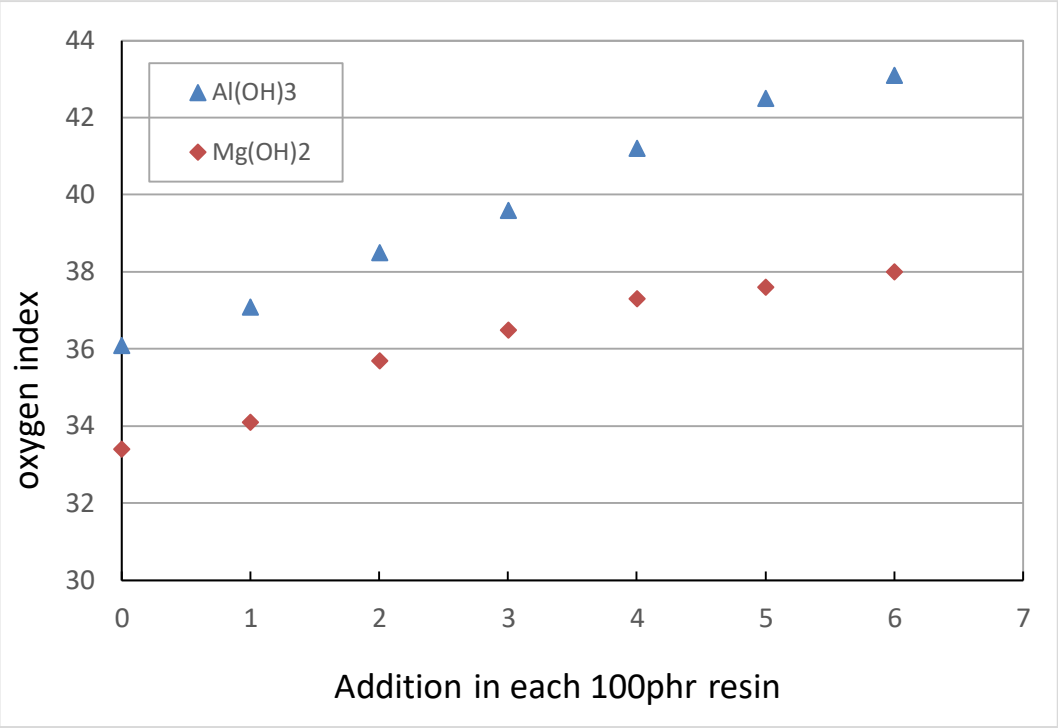
Rheological Performance Test





With the addition of Javachem®GT, it can obviously improve rheological performance

Flame-retardant Performance Test



Combustion remainder

Blank

1.5% Javachem®GT

With the addition of Javachem®GT, the product's oxygen index and flame-retardant performance can both being improved

Extrusion Line Test

ϕ3mm die extrusion line

Blank

Javachem®GT

5min 10min 30min 60min

With the addition of Javachem®GT, there is a significant reduction to die drool and cable surface get better abrasion resistance

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Application summary

Javachem®GT Silioxane Additives:

1. Improve processing performance and reduce torque

2. Improve die drool, enhance surface performance and promote line speed

3. Synergistic effect with flame retardancy and enhance oxygen index (LOI)

4. No migartion and exudation, no influence on printing property

5. Satisfy different requirements of customers

Thank you !