

Momentive Solutions

Halogen-Free Formulated Flame Retardant Additives



Typical Properties of Silicones vs. Organics

Bond	Length [nm]	Bond Energy [KJ/mol]	Rotation Barrier [Kcal]
Si-O	0.165	445	<0.2
C-C	0.154	346	3.6
Si-C	0.192	306	1.6



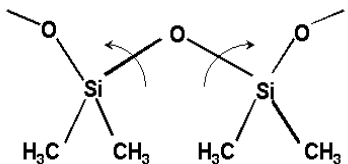
KEY FEATURES OF SILICONE

- Low Surface Energy
- Moisture, Temperature and Oxidation Resistance
- UV Stability
- Biocompatibility
- Insulation Properties

SPECIALTY SILICONES CAN BE:

- Reactive or Inert
- Elastomeric, Rigid or Fluid
- Release Agents or Adhesives
- Anti-Foams or Surfactants
- Thickeners or Solvents
- Flame Retardant Agents

MOLECULAR FEATURES OF SILICONE:



Increased Stability via Higher Bond Energy

Stability

Greater Permeability via Longer Bond Length

Permeability

Lower Rotational Barrier

Flexibility

Typical properties are average data and are not to be used as or to develop specifications.

MOMENTIVE SOLUTION

Silicone Fluid Flame Retardant Synergist.

KEY FEATURES

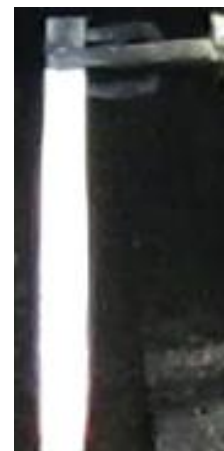
- Multifunctional additive
- Compatibility with Many Engineering Thermoplastics Including High Temp. Materials
- Synergies with Organic & Inorganic FR
 - Phosphorous Flame Retardants
 - Group II & Group III Metal Hydroxides
- Halogenated Flame Retardants Alternative

TYPICAL BENEFITS

- Reduced Flame Out Time & Flaming Drip
- Flame Propagation Inhibition
- Reduced Smoke Density
- Improved Low Temp. Impact Properties
- Improved Processability



Without SFR100



With SFR100

SFR100 FLAME RETARDANT PERFORMANCE IN PP

SFR100 Non-Halogen Formulated, Silicone Flame Retardant – Sample Formulation

No	Composition [%]				FR Testing (1.6mm)	Smoke Density	Izod Impact Notched [-20°C]
	PP	Amonium Polyphosphate	Pentaerithritol	SFR100	UL94	[%]	[KJ/m ²]
1	77.6	17.4	5	0	Consumed	41	17
2	73.1	17.4	5	4.5	V0	29	35

Test data. Actual results may vary.

Formulations Improved from
“Consumed” to “V0”

Significant
Reduction in
Smoke Density

Doubled Izod Notch
Impact at Lower
Temp. i.e. -20°C

Product formulations are included as illustrative examples only. Momentive makes no representation or warranty of any kind with regard to any such formulations, including, without limitation, concerning the efficacy or safety of any product manufactured using such formulations.

SFR100 FLAME RETARDANT PERFORMANCE IN PC



SFR100 Non-Halogen Formulated, Silicone Flame Retardant – Sample Formulation

Test	Composition [%]				FR Testing (1.6mm)	Izod Impact Notched [%age Increase]	
	PC	Primary FR	Anti-Drip	SFR100		[21°C]	[-30°C]
1	87.2	12	0.2	0	V0	1	1
2	89.3	10	0.2	0.5	VO	14	37
3	85.8	10	0.2	4	VO	650	204
4	91.8	4	0.2	4	VO	670	289

**Mechanical Properties of PC
Greatly Improved.**

**...While Maintaining
Overall V0 FR
Performance**

**With a
Significantly
Reduced Amount
of Primary FR**



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Testing video for SFR100 Performance

Test data. Actual results may vary.

MOMENTIVE SOLUTION

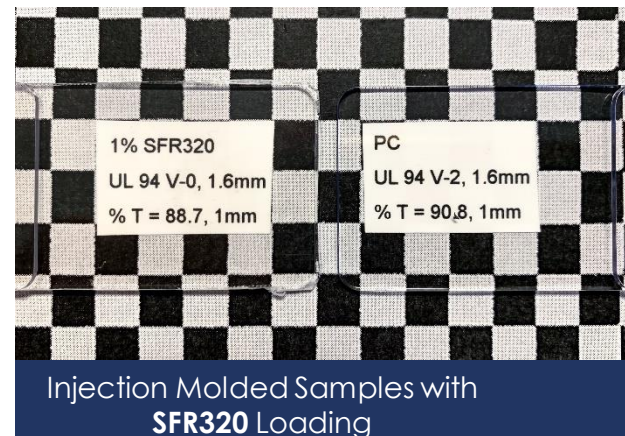
Phenyl-Substituted Silicone Fluid Offering Excellent Flame Resistance in Clear Polymers With High Miscibility By Maintaining Optical Transparency.

KEY FEATURES

- Low Viscosity
- Primary Flame Retardant in PC
- 100% Active
- Effective at Lower Concentrations
- Typical Usage level 1% - 2%
- Compatibility with Many Polymers

TYPICAL BENEFITS

- Sustained Transparency
- Reduced Flame Out Time & Flaming Drip
- Flame Propagation Inhibition
- Improved Processability



SFR320 Performance in PC

SFR320 Flame Retardant – Composition Example

No	Composition [%]				FR Testing [1.6mm]	Transparency [1mm]	MFI [300°C/1.2Kg]	Izod Impact Notched [-30°C]
	PC 1	PC 2	Anti-drip*	SFR320	UL94**	[%]	[g/10min]	[KJ/m²]
1	100	0	0	0	V2	89	7	12
2	99.85	0	0.15	0	V2	88	-	17
3	95.85	0	0.15	4	V0	88	17	8
4	0	100	0	0	V2	89	3	15
5	0	99.9	0.1	0	V2	89	-	12
6	0	99.7	0.1	0.2	V0	89	5	11

Adding SFR320 Along
With Anti-Drip, V0
Rating With
Improved Flow
Achieved.

While Maintaining the
Same Level of
Transparency & Lower
Temp. Impact.

PC1: General purpose medium viscosity non-FR Polycarbonate

PC2: High viscosity non-FR Polycarbonate

* Potassium perfluorobutane sulphonate

**Test results are composition, molding & operator dependent

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Test data. Actual results may vary.