

**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



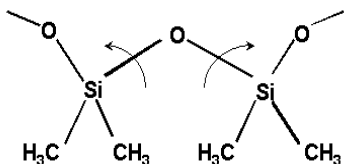
## KEY FEATURES OF SILICONE

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

## SPECIALTY SILICONES CAN BE:

- Reactive or Inert
- Anti-Foams or Surfactants
- Elastomeric, Rigid or Fluid
- Thickeners or Solvents
- Release Agents or Adhesives
- 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 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 <sup>2</sup> ]
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	UL 94	[21°C]	[-30°C]
1	87.2	12	0.2	0	VO	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 VO FR  
Performance

With a  
Significantly  
Reduced Amount  
of Primary FR



Testing video for SFR100 Performance

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## MOMENTIVE SOLUTION

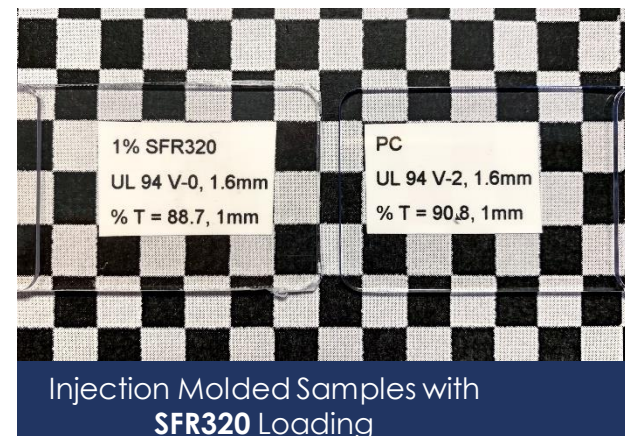
Phenyl-Substituted Silicone Fluid Offering Excellent Flame Resistance in Clear Polymers With High Miscibility By Maintaining Optical Transparency.

### 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 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	<b>95.85</b>	<b>0</b>	<b>0.15</b>	<b>4</b>	<b>V0</b>	<b>88</b>	<b>17</b>	<b>8</b>
4	0	100	0	0	V2	89	3	15
5	0	99.9	0.1	0	V2	89	-	12
6	<b>0</b>	<b>99.7</b>	<b>0.1</b>	<b>0.2</b>	<b>V0</b>	<b>89</b>	<b>5</b>	<b>11</b>

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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