MOMENTIVE™

Marketing Bulletin

Silsoft* Dimethicone Copolyol Conditioning Agents

Potential Description

Silsoft dimethicone copolyols are multifunctional, surface tension reducing molecules. The dimethicone portion of these materials deliver excellent conditioning and gloss in hair care products and excellent sensory in skin care formulations. The polyether component of the material results in emulsification properties, differentiated solubility and compatibility along with ease of use during processing. Modifying these two portions of the molecular structure independently creates a range of materials that offer diverse foaming, solubility, emulsification and pigment dispersion and wetting benefits.

Typical Chemical Properties

Dimethicone Copolyol Conditioning Agent	INCI Name	Molecular Architecture	Reactive Hydroxy Functionality
SF1288	PEG-12 Dimethicone	Pendant	Yes
SF1528	Cyclopentasiloxane (and) PEG/PPG-20/15 Dimethicone	Pendant	No
SF1540	Cyclopentasiloxane (and) PEG/PPG-20/15 Dimethicone	Pendant	No
Silsoft 430	PEG/PPG 20/23 Dimethicone	Pendant	Yes
Silsoft 440	PEG/PPG 20/23 Dimethicone	Pendant	No
Silsoft 475	PEG/PPG 23/6 Dimethicone	Pendant	Yes
Silsoft 805	PEG-8 Dimethicone	Pendant	No
Silsoft 810	PEG-8 Dimethicone	Linear	Yes
Silsoft 860	PEG-10 Dimethicone	Linear	Yes
Silsoft 870	PEG-12 Dimethicone	Linear	Yes
Silsoft 875	PEG-12 Dimethicone	Pendant	Yes
Silsoft 880	PEG-12 Dimethicone	Pendant	Yes
Silsoft 895	PEG-17 Dimethicone	Pendant	Yes
Silsoft 900	PPG-12 Dimethicone	Linear	Yes
Silsoft 910	PPG-12 Dimethicone	Pendant	Yes

Key Features and Typical Benefits

Structural diversity to cover a wide range of personal care formulation needs:

Key Feature	Typical Benefit
■ range of solubility (hydrophilic to lipophilic)	■ formulation flexibility
■ low interfacial tension	■ emulsifier/dispersant/foamant
■ low surface tension	■ easily wets many surfaces
■ low odor and toxicity	■ chemical modification
■ reactive hydroxy component	

Typical Physical Properties

Silsoft Dimethicone Copolyol Conditioning Agent	Appearance	Viscosity (cSt)	Flash Point (°F)	Cloud Point (°C)	Pour Point (°C)	Estimated HLB	Refractive Index @ 25°C	Ross Miles Foam Height (mm)	0.1% Surface Tension (mN/m)
SF1288	Colorless liquid	250-600	>302	77	18	High	1.450	138	27.9
SF1528	Colorless liquid	250	170	(b)	-49	Low		(b)	(b)
SF1540	Cream to white liquid	10,000-50,000	145	(b)	2	Low	1.407	(b)	(b)
Silsoft 430	Clear, pale liquid	4000	250	40	-32	Medium		119	32.4
Silsoft 440	Clear, pale yellow liquid	1700	206	39	-48	Medium	1.447	58	28.2
Silsoft 475	Clear, pale liquid	2500	230	77	4	High	1.452	102	34.2
Silsoft 805	Clear, pale yellow liquid	400	230	(b)	2	Low	1.442	Insoluble	(b)
Silsoft 810	Clear, straw liquid	125	270	(a)	-7	Low		16	25.7
Silsoft 860	Clear, straw liquid	174	270	–	15	Medium	1.442	63	30.7
Silsoft 870	Clear, straw liquid	220	250	76	13	High		86	25.4
Silsoft 875	Amber liquid	300-500	>200	85	18	High		95	28
Silsoft 880	Pale yellow liquid	600	265	89	13	High	1.457	118	27.6
Silsoft 895	Straw colored liquid	----	285	>100	28	High	1.453	97	35.6
Silsoft 900	Clear, straw liquid	250	235	(b)	-48	Low	1.435	Insoluble	(b)
Silsoft 910	Clear, straw liquid	720	>200	(b)	-53	Low		Insoluble	(b)

a = dispersible in water at 1% (w/w) but hazy

b = insoluble in water, not measured

Cloud point: Typical values measured visually on 1% (w/w) solutions

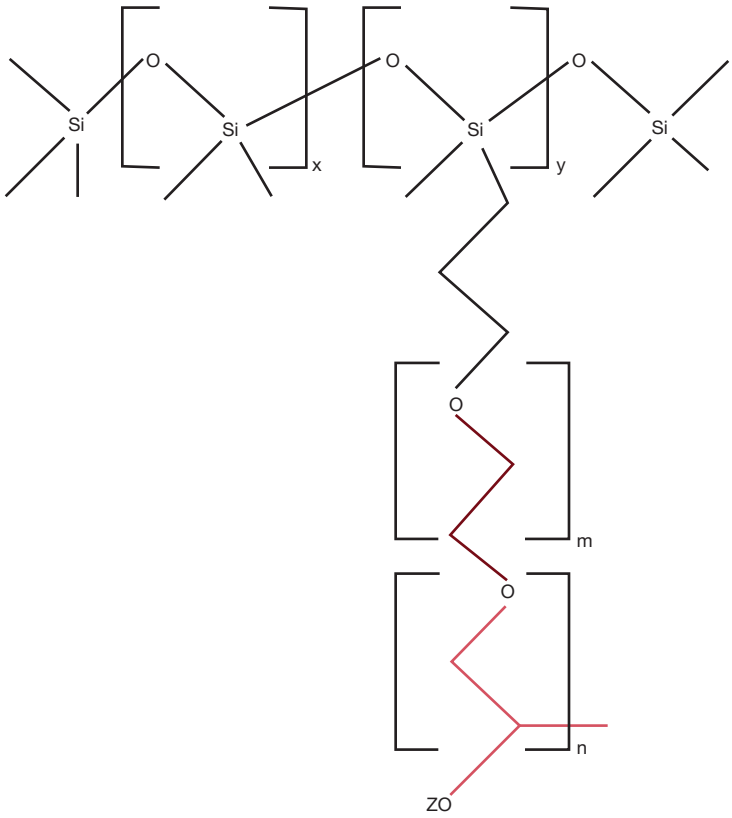
HLB: Estimated ranges based on water solubility and cloud points, Low (5-8), medium (9-12), high (13-17).

Ross Miles: 1% solutions, 5 min reading, ASTM D1173-53

Surface tension: Typical values at 25°C on 0.1% (w/w) aqueous solutions

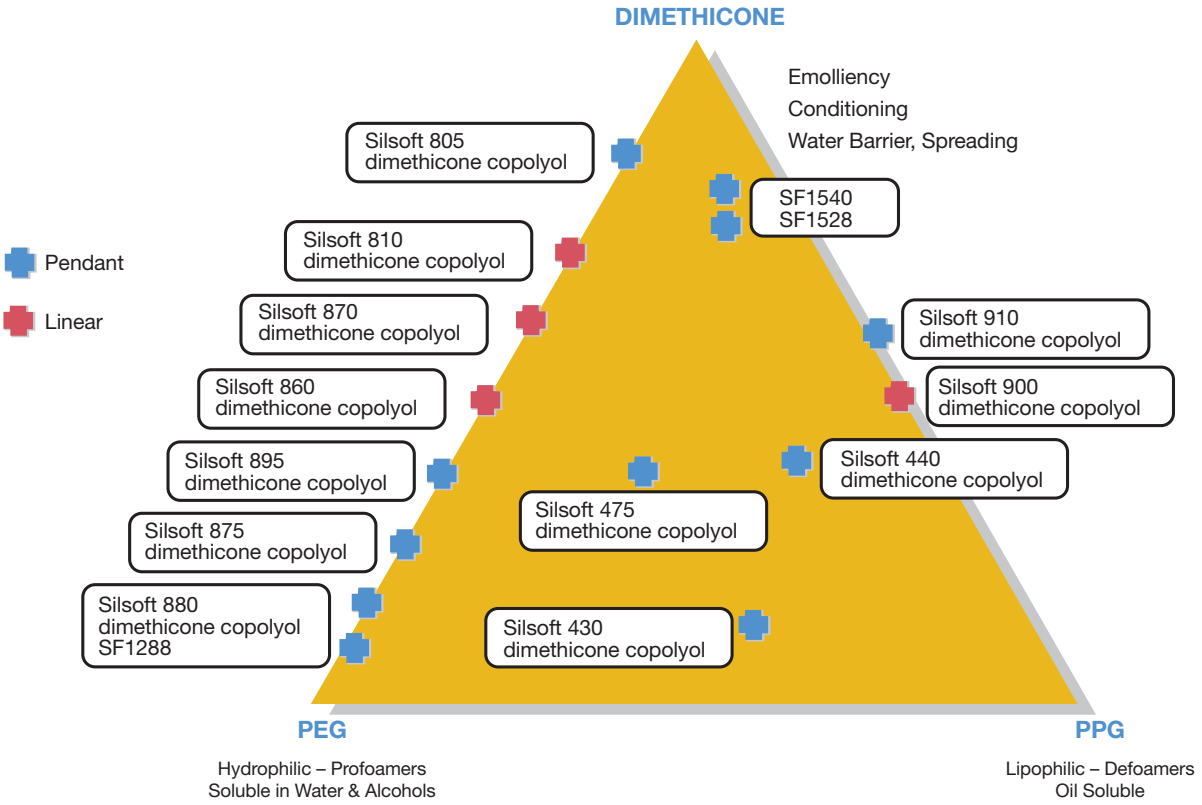
Chemical Structure

Structural Diversity



Excellent structural diversity for an extensive product line

Silsoft dimethicone copolyol molecules consist of a dimethicone chain with one or more silicone atoms attached to a polyether chain that may contain PEG groups (in blue) or PPG groups (in red). By varying the components x, y, m, n and changing the nature of the capping group Z, a wide variety of properties will result.



Product formulations presented in this section are included as illustration examples only. MOMENTIVE PERFORMANCE MATERIALS MAKES NO REPRESENTATION OR WARRANTY CONCERNING THE EFFICACY, SAFETY OR SUITABILITY OF ANY PRODUCT MANUFACTURED USING SUCH FORMULATIONS. All statements concerning the possible uses of Momentive Performance Materials Products are for research purposes only.

Silsoft Dimethicone Copolyol Selection Guide

Each corner of the triangle either represents 100% dimethicone, 100% PEG or 100% PPG. The properties of the Silsoft dimethicone copolyol can be estimated depending upon its position within the selector triangle relative to the corners.

Silsoft dimethicone copolyols situated at the top of the triangle exhibit properties similar to 100% Dimethicone. They can impart emolliency and are considered hydrophobic with a low surface tension. They act as effective emulsifiers for W/S emulsions and provide excellent conditioning properties.

Silsoft dimethicone copolyols closer to the PEG corner are water soluble, with a high cloud point and promote foaming. These highly soluble copolyols perform extremely well in shampoos and body washes where foam and conditioning is desirable.

Silsoft dimethicone copolyols closer to the PPG corner are oil soluble with a low cloud point and act as defoamers. These water insoluble copolyols are strong dispersing agents for inorganic pigments.

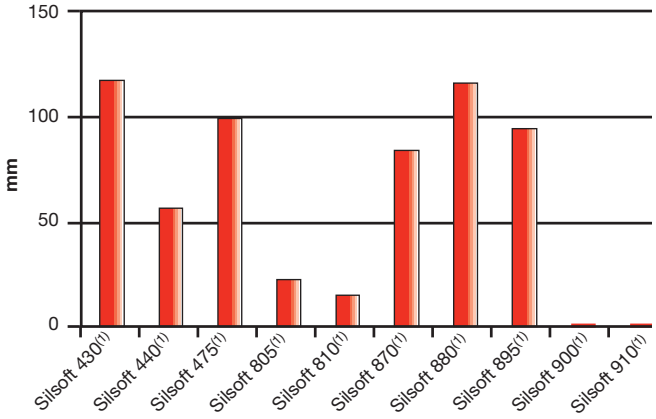
Silsoft dimethicone copolyols situated in the center of the triangle exhibit tendencies of both the PEG and PPG properties.

Application Information

Silsoft Dimethicone Copolyols as Foam Agents

Since traditional HLB definitions do not work with silicones, cloud points are used to estimate water solubility and foaming capabilities. A higher cloud point indicates higher water solubility. In Silsoft dimethicone copolyols, the cloud point trend follows the % of PEG in the copolymer. The greater the percentage of PEG in the copolyol, the higher the water solubility and the higher the foaming capability.

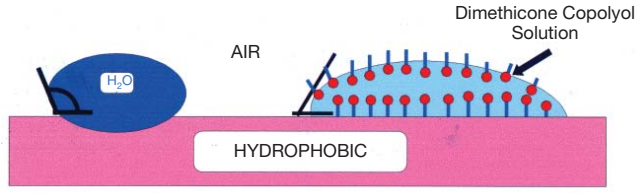
Ross Miles Foam Height



(1) dimethicone copolyol

Silsoft Dimethicone Copolyols as Wetting Agents

Measuring the contact angle (the angle at which a liquid/vapor interface meets the solid surface) denotes the wetting ability of a material. The lower the contact angle, the better the wetting capability. Water has a very high contact angle, as depicted on the left of the image, while the copolyol solution completely wets out the substrate at 0.1% concentration



	Polyester Contact Angle	HD Polyethylene Contact Angle
Water	73	82
Sodium Lauryl Sulfate (1%)	36	30
Alcohol Ethoxylate (7 mol)	11	2
Dimethicone Copolyol (0.1%)	1	0

The longer the PEG chain length, the greater the foaming and the higher the cloud point.

By reducing the contact angle, Silsoft dimethicone copolyol can provide better spreading and wetting in finished formulations.

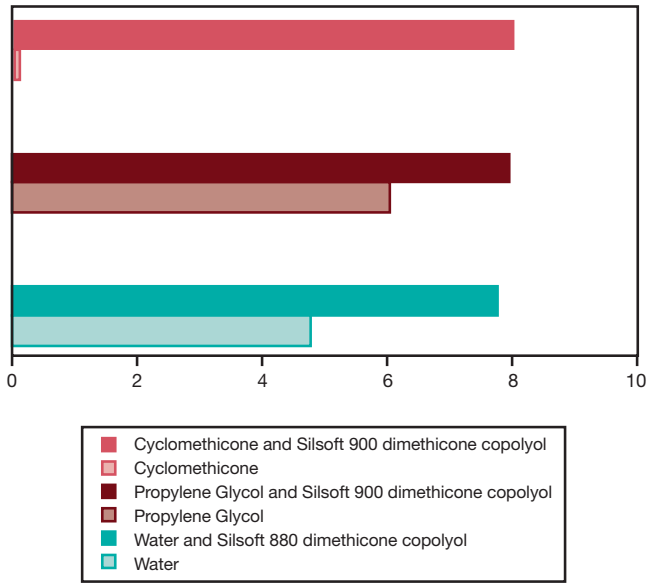
Silsoft Dimethicone Copolyols as Pigment Dispersants

Silsoft dimethicone copolyols are dispersants for pigments in a variety of media due to their unique solubility levels.

Model Pigment Composition	
Cosmetic Red	5.7%
Cosmetic Black	0.8%
Cosmetic Brown	0.8%
Cosmetic Tan	8.3%
Zinc Oxide	84.4%

Dispersions were prepared by incorporating the model pigment composition into a selection of media containing 1% by weight a Silsoft dimethicone copolyol. The particle dispersions were evaluated using a grind gauge and reported on a Hegman scale (1-coarse, 8-fine).

Silsoft Dimethicone Copolyols as Dispersants



Silsoft dimethicone copolyol at 1% dramatically improves the dispersibility of pigments for use in color cosmetics and physical sunscreens.

Solubility Selector

Silsoft Dimethicone Copolyol Conditioning Agent	Water	Ethanol	Mineral Oil	Propylene Glycol	Cyclomethicone	Isopropyl Myristate
SF1288	S	S	I	S	I	I
SF1528	I	D	I	I	I	I
SF1540	I	D	I	I	I	I
Silsoft 430	S	S	D	D	D	D
Silsoft 440	S	S	D	S	D	S
Silsoft 475	S	S	I	S	I	I
Silsoft 805	I	S	I	I	D	I
Silsoft 810	D	S	S	S	D	D
Silsoft 860	S	S	D	S	D	D
Silsoft 870	S	S	D	S	D	D
Silsoft 875	D	S	I	S	I	I
Silsoft 880	S	S	D	D	D	I
Silsoft 895	S	S	I	S	I	I
Silsoft 900	I	S	D	D	S	S
Silsoft 910	I	S	D	D	D	S

10% concentration of Silsoft dimethicone copolyol in 90% solvent
D = Dispersible S = Soluble I = Insoluble

SILSOFT* Dimethicone Copolyol conditioning agent

Application Selector

	Hair Care					Shower & Bath		Color Cosmetics		Shaving		AP/DEO	
Silsoft Dimethicone Copolyol Conditioning Agent	**Shampoo**	**Curl Activator**	**Waxes / Pomades**	**Mousse**	**Spray / Fixative**	**Liquid Soap**	**Shower Gel**	**Foundation**	**Lipstick**	**Pre- / After Shave Lotions**	**Shave Foam**	**Aerosol**	**Roll-on**
SF1288	♦	♦	♦	♦	♦	♦	♦	♦		♦	♦	♦	♦
SF1528[(1)]			♦					♦	♦	♦			♦
SF1540[(1)]			♦					♦	♦	♦			♦
Silsoft 430	♦	♦	♦	♦	♦	♦		♦		♦		♦	♦
Silsoft 440	♦	♦	♦	♦	♦	♦	♦	♦		♦	♦	♦	♦
Silsoft 475	♦	♦			♦	♦	♦			♦	♦		
Silsoft 805						♦				♦			
Silsoft 810										♦			
Silsoft 860	♦			♦		♦	♦			♦	♦		
Silsoft 870	♦	♦			♦	♦	♦	♦		♦	♦	♦	♦
Silsoft 875	♦	♦	♦	♦	♦	♦	♦	♦		♦	♦	♦	♦
Silsoft 880	♦			♦	♦	♦	♦	♦		♦	♦	♦	♦
Silsoft 895	♦			♦		♦	♦			♦	♦		
Silsoft 900			♦						♦				
Silsoft 910			♦						♦				

(1) SF1528 and SF1540 are both excellent emulsifiers in Skin & Sun Care Products.

*Silsoft is a trademark of Momentive Performance Materials Inc.

Formulations

Anti-Aging Moisturizing Sunscreen

Phase	Material	wt/wt%
A	**SF1540 (**Cyclopentasiloxane (and) **PEG/PPG-20/15 Dimethicone**	**2.5**
	Velvesil* DM silicone (Dimethicone (and) Cetearyl Dimethicone Crosspolymer	20
	SF96-5 (Dimethicone 5cSt)	5.0
	Octyl Methoxy Cinnamate	3.7
	Octyl Salycilate	2.2
	Benzophenone-3	2.2
	Butylmethoxydibenzoylmethane	1.1
	C12-15 alkyl benzoate	1.5
	Caprylyl/caprylic triglyceride	1.3
	Sorbitan Oleate	0.5
B	Glycerin	15
	Water	q.s. to 100%†
	Sodium Chloride	0.99
	Preservative	Per label directions
	Fragrance	Per label directions
C	Tocopherol Acetate	0.1
	Retinol Palmitate	0.1
	Bisabolol	0.5
	Sodium Ascorbyl Phosphate	0.1

† quantum sufficit (as much as suffices)

Procedure:

1. Combine phase A, heat to 65°C
2. Combine phase B, heat to 65°C
3. Slowly add phase B to phase A with moderate stirring
4. Cool to 30°C with moderate mixing
5. Add part C, fragrance and preservative
6. Homogenize if needed

Light Satin Face and Body Lotion

Phase	Material	wt/wt%
A	Sorbitan Oleate	0.6
	SF1528 (Cyclopentasiloxane (and) PEG/PPG-20/15 Dimethicone)	10
	Velvesil 125 crosspolymer network (Cyclopentasiloxane (and) C30-45 Cetearyl Dimethicone Crosspolymer)	5.0
	SF1202 (Cyclopentasiloxane)	11
B	Butylene Glycol	1.0
	Sodium Chloride	1.0
	Quaterniuim-15	0.1
	Water	q.s. to 100%†

† quantum sufficit (as much as suffices)

Procedure:

1. Combine phase A in order of ingredients shown, mix thoroughly after each addition
2. Combine phase B, mix well
3. Slowly add phase B to phase A with moderate stirring
4. Gradually increase shear as mixture thickens
5. Continue mixing 20 minutes
6. Homogenize

Formulations (continued)

Facial Serum

Phase	Material	wt/wt%
A	**SF1202** (Cyclopentasiloxane)	14
	Tospearl* 145A silicone microspheres (Polymethylsilsesquioxane)	5.0
	SF1540 (Cyclopentasiloxane (and) PEG/PPG-20/15 Dimethicone)	3.0
	Velvesil* 125 crosspolymer network (Cyclopentasiloxane (and) C30-45 Alkyl Cetearyl Dimethicone Crosspolymer)	5.0
B	Water	q.s. to 100%†
	Silsoft 880 dimethicone copolyol (PEG-12 Dimethicone)	2.0
	Glycerin	10
	Butylene Glycol	10
	Sodium Chloride	1.0
	PEG-100 Stearate	2.0
C	Tocopheryl Acetate	0.5
D	Preservative	Per label directions
E	Fragrance	Per label directions

† quantum sufficit (as much as suffices)

Procedure:

1. Combine phase A, heat to 40°C
2. Combine phase B, heat to 60-65°C, mix well
3. Cool phase B to 40°C
4. Add phase B into phase A, mix with moderate shear
5. Cool to 35°C, add phase C, D, and E
6. Homogenize, cool and pack

Shave Cream

Phase	Material	wt/wt%
A	Stearic Acid	8.0
	Laureth 23	2.0
B	Water	q.s. to 100%†
	Sodium Lauryl Ether Sulfate	7.0
	Triethanolamine	6.3
	Acrylates/Octylacrylamide Copolymer	2.0
	Silsoft 895 dimethicone copolyol (PEG-17 Dimethicone)	5.0
C	Preservative	Per label directions
D	Fragrance	Per label directions

† quantum sufficit (as much as suffices)

Procedure:

1. Combine phase A, heat to 80°C, mix 15 minutes
2. Combine phase B (except Acrylates/Octylacrylamide copolymer), heat to 80°C, mix well, slowly add Acrylates/Octylacrylamide copolymer
3. Cool phase B to phase A, cool to 40°C
4. Add phase C and D
5. Cool completely and pack

Patent Status

Technical subject matter in this publication is described and protected by one or more pending US patent applications and foreign counterparts.

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