



Silsoft^{*} A⁺ conditioning agent

Product Description

Silsoft A⁺ conditioning agent can help provide excellent conditioning to damaged hair. Silsoft A⁺ conditioning agent is a surfactant-free emulsion of an *Amino (AB)n multiblock copolymer silicone* with an optimal hydrophilic/hydrophobic balance. Silsoft A⁺ conditioning agent typically has enhanced deposition onto damaged hair compared to traditional amino silicones, therefore, offering better performance at same active levels. This feature potentially can be translated into significant cost-saving benefits.

Proposed INCI Designation: *Polysilicone X (and) glycerin (and) DPG*

Key Features and Typical Benefits

- Typically delivers excellent conditioning and moisturization to damaged hair
- Helps promote fiber-fiber alignment
 - Anti static/Anti-frizz
 - Curl definition for bleached hair
- Generally enhanced deposition onto damaged hair compared to aminosilicones
- Surfactant-free emulsion
- Optimal hydrophilic/hydrophobic balance
- Easy to use emulsion

Typical Physical Properties⁽¹⁾

| | |
|---------------------|---------------------|
| Appearance | Light yellow liquid |
| Viscosity, cps | Max. 10,000 |
| Silicone Content, % | 30 |

(1) Typical data are average data. The actual values may vary. Product specifications for specific applications need to be agreed upon individually.

Potential Applications

- Shampoos (clear and opaque)
- Rinse-off conditioners
- Aqueous leave-on products
- Hair coloring products
- Products for damaged hair
- Styling products
- Body washes
- Liquid hand soaps
- Soap bars

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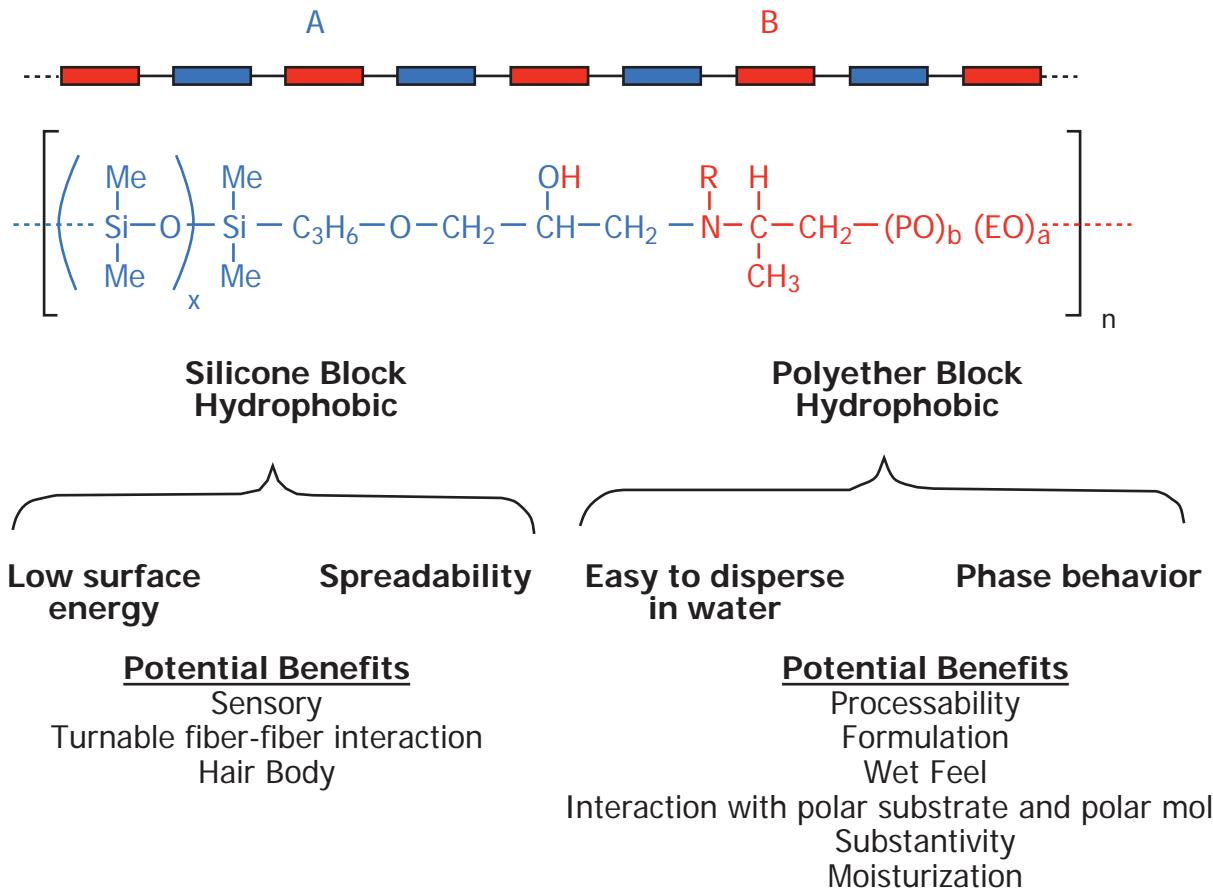
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solve product, process, and performance problems; our silanes, fluids, elastomers, sealants, resins, adhesives, urethane additives, and other specialty products are delivering innovation in everything from car engines to biomedical devices.

From helping to develop safer tires and keeping electronics cooler, to improving the feel of lipstick and ensuring the reliability of adhesives, our technologies and enabling solutions are at the frontline of innovation.

Chemistry

Silsoft A+ conditioning agent is a surfactant-free emulsion of an *Amino (AB)n* multiblock copolymer silicone.



Performance Data

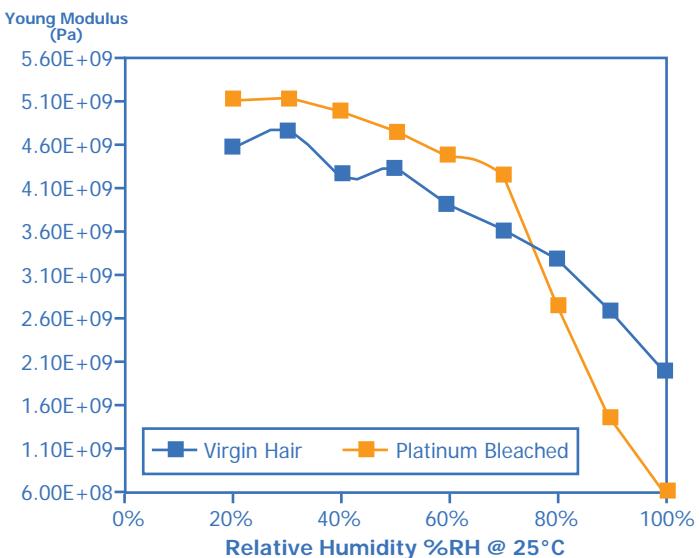
Hair Moisturization

Hair normally has moisture content of approximately 10%. If the hair's moisture content drops below this level it feels dry, does not shine and is difficult to style.

Hair feels dry because the cuticle has become heavily weathered and porous, so the cortex cannot retain water.

The Young elasticity modulus reflects the integrity of the keratin network and its affinity with moisture on hair. Monitoring of the Young elasticity modulus as a function of relative humidity allows assessment of hair moisturization.

Figure 1: Young Modulus vs. Relative Humidity



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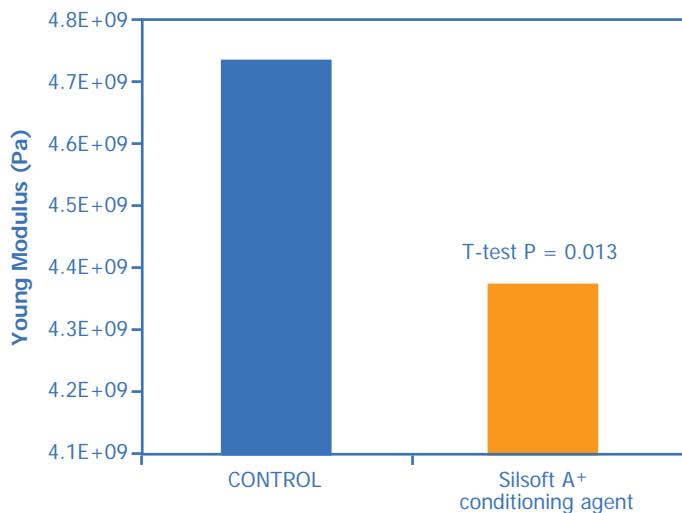
Performance Data (continued)

Hair Moisturization (continued)

Platinum bleached hair treated with a leave-on dispersion of 0.3% active Silsoft A+ conditioning agent showed a significant lower Young modulus than untreated platinum bleached hair at low humidity (Figure 2). The hair tress was dipped for 1 minute in the dispersion and dried.

The restoration of the hair water retention capacity, in addition to the imparted soft feel, makes Silsoft A+ conditioning agent an excellent choice to consider for products targeted to repair damaged dry hair.

Figure 2: Moisturization Efficiency



Hair fiber – Young modulus at 30% RH (average of 20 measurements, overnight equilibration). Control: untreated platinum bleached hair. Silicone treatment: 0.3% active Silsoft A+ conditioning agent on hair.

Note: Test data. Actual results may vary.

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

Deposition Efficiency onto Damaged Hair

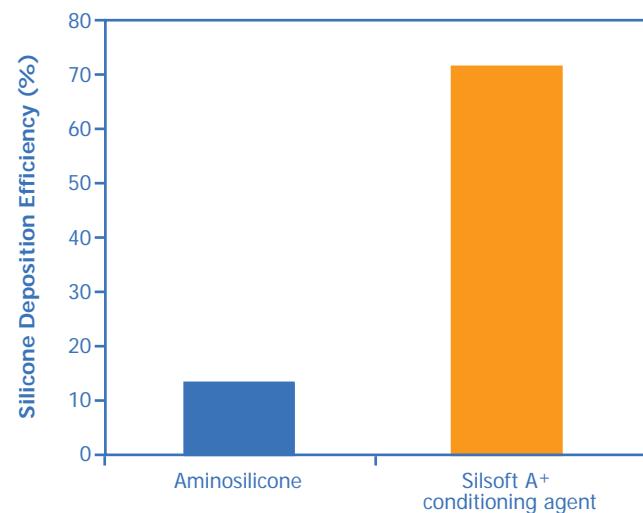
The deposition efficiency of Silsoft A+ conditioning agent and a microemulsion of an aminosilicone were compared on damaged hair.

Deposition

Hair wash protocol: Tresses were washed with 10% sodium laureth sulfate solution (20 rubs) and then rinsed for 30 seconds 0.25 gram conditioner/gram of hair was applied to the tresses (20 rubs) and they were then rinsed for 30 seconds in lukewarm tap water (flow rate ~ 4 l/min).

Silicone deposition efficiency was measured using a digestion method followed by gas chromatography. Figure 3 displays the silicone deposition efficiency from a nonionic conditioner formula containing 0.7% silicone.

Figure 3: Deposition from Non-ionic Conditioner



Silsoft A+ conditioning agent deposited much more efficiently onto damaged hair than the regular aminosilicone microemulsion.

Nonionic Conditioner Formulation

| Ingredient | Wt % |
|--|-------------|
| Glyceryl stearate (and) Ceteareth-20 (and) ceteareth-12 (and) cetearyl alcohol (and) Cetyl palmitate | 10 |
| Test silicone | 0.7 or 1.4 |
| Water | q.s. to 100 |

These data are consistent with the dry combing force reduction data shown in Figure 4. **To achieve a certain level of conditioning, the active level of Silsoft A+ conditioning agent in the final formulation typically can be much lower than the level of the aminosilicone microemulsion. In addition, Silsoft A+ conditioning agent generally does not build-up and does not weigh-down hair after multiple applications.**

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Performance Data (continued)

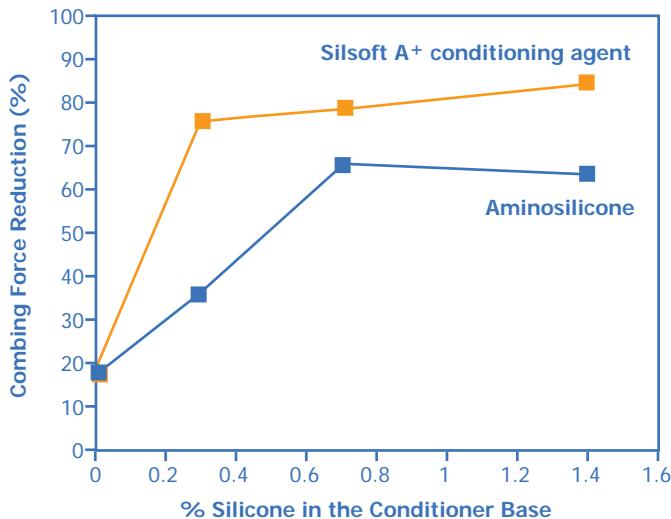
Dry Combing Force Measurements

Three active levels (0.3%, 0.7% and 1.4%) of Silsoft A+ conditioning agent and of a microemulsion of an aminosilicone were tested in the nonionic conditioner formula – with no added depositing polymer.

4-gram tresses of platinum bleached hair were washed and conditioned using 1ml of the designated formulation according to the protocol described earlier and then dried.

Dry combing force was measured using a Dia-Stron combing force apparatus. The dried hair tresses were conditioned overnight in a 50% RH humidity chamber prior to measurement (Figure 4).

Figure 4: Dry Combing Force vs. Silicone Concentration



The conditioners containing Silsoft A+ conditioning agent showed significantly higher reductions in combing force, even at very low silicone concentration levels such as 0.3%, compared to the aminosilicone.

Note: Test data. Actual results may vary.

Dry Conditioning Performance

Ease of combability is one of the most important benefits desired by consumers.

Silsoft A+ conditioning agent was added to 2 rinse-off Cationic Conditioners, A and B, and to the Nonionic Conditioner formula described above.

Dry combing force measurements were performed on platinum bleached hair tresses as described in the previous section.

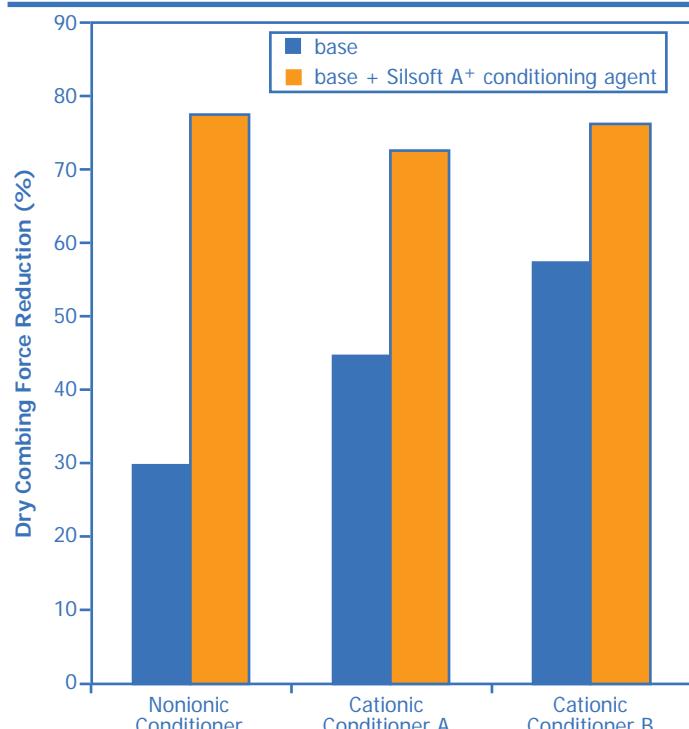
The conditioners formulated with Silsoft A+ conditioning agent outperformed all three conditioners that did not contain silicone (Figure 5). Silsoft A+ conditioning agent typically makes it possible to achieve excellent dry combing performance (Nonionic Conditioner and Cationic Conditioner A) without the use of monoalkylquats.

Rinse-off Cationic Conditioners

| Ingredients | Base A wt% | Base B wt% |
|--------------------------------|------------|------------|
| Behenamidopropyl dimethylamine | 1.7 | 0 |
| Cetrimonium chloride | 0 | 1.5 |
| Cetearyl alcohol | 3.3 | 3 |
| Lactic acid | 0.5 | – |
| Silsoft A+ conditioning agent | 4.7 | 4.7 |
| Water | q.s 100 | q.s 100 |

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Figure 5: Dry Combing Force



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Silsoft* A+ conditioning agent

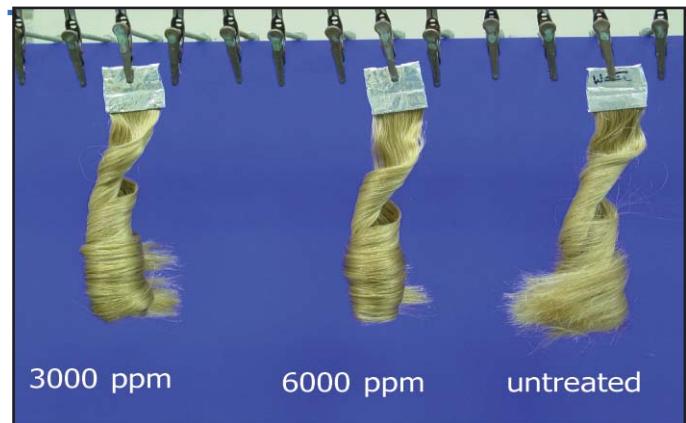
Performance Data (continued)

Curl Definition for Bleached Hair

Curl definition is also a highly desirable benefit, but difficult to achieve without introducing undesirable qualities, such as oily appearance or tackiness. With leave-on formulations, fiber-fiber interactions potentially can be enhanced to an optimum level that may result in good curl definition without delivering a visible oily look. Fiber-fiber interaction strength was measured using the Hair Loop Sliding Method.

Protocol: Clean platinum bleached tresses were treated according to the following protocol: Treated tresses were dipped for 1 minute in 0.3% and 0.6% silicone active aqueous solutions of Silsoft A+ conditioning agent respectively, curled on a roller and dried under a bonnet. The untreated tress was dipped in water, curled on a roller and dried under bonnet. After the roller was removed, tresses were placed in an environmental chamber at 25°C and 75% RH for 1 hour. A picture was then taken. Fifteen hair fibers from each tress were taken to measure fiber-fiber interaction strength.

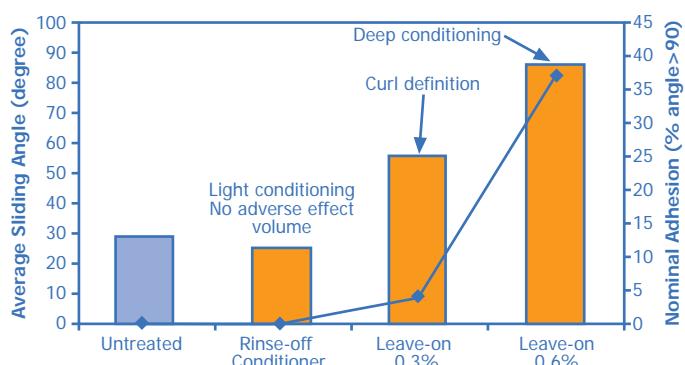
Figure 6



Silsoft A+ conditioning agent helped achieve good curl definition and generally gave an antistatic effect while providing a soft and light touch.

Note: Test results. Actual results may vary.

Figure 7: Fiber-fiber Interaction Strength



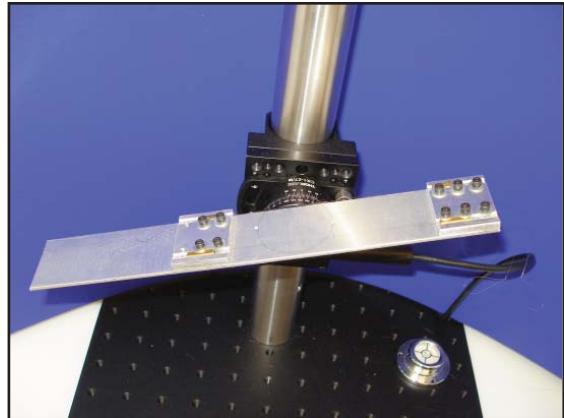
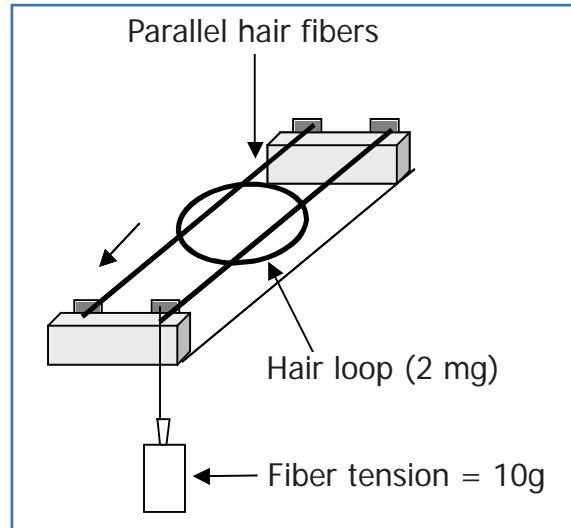
Note: Test data. Actual results may vary.

Fiber-fiber interaction strength measured on bleached hair. Rinse-off conditioner had 1.4% silicone actives of Silsoft A+ conditioning agent active. Concentration for leave-on experiments is the silicone active concentration on hair.

Performance Data (continued)

Fiber-fiber Interaction Measurements

Sliding Hair Loop Apparatus



Sliding angle θ

Low load coefficient of friction, adhesion forces

Patent Status

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