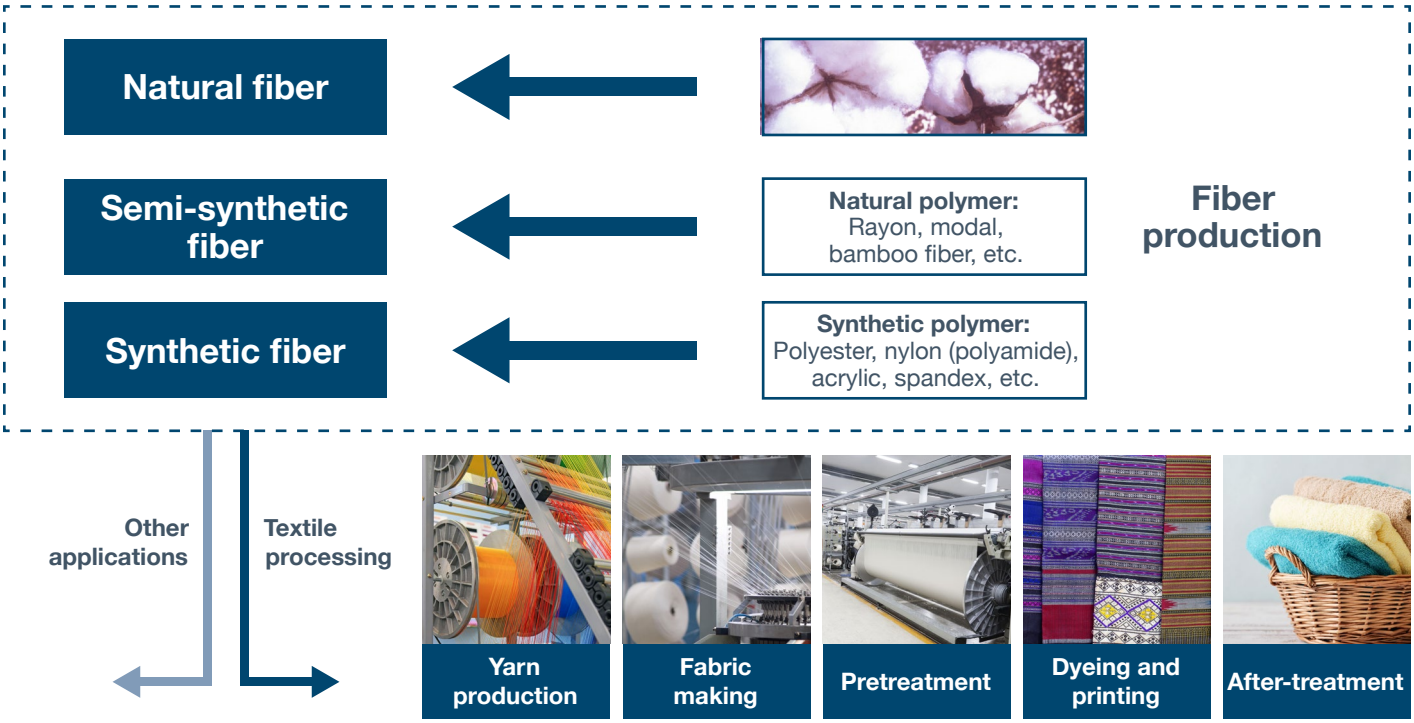
High performance solutions for textile auxiliaries

As a global leader in textile auxiliary chemicals and related technical solutions, Dow Industrial Solutions offer high performance products to meet our customers' needs and future demand.

Our highly recognized brands in textile market include:

- ECOSURF™, TERGITOL™, TRITON™, DOWFAX™ Nonionic and Anionic Surfactants
- CARBOWAX™ Polyethylene Glycols, Polypropylene Glycols
- UCON™ and SYNALOX™ Polyalkylene Glycols
- DOWANOL™, CARBITOL™, CELLOSOLVE™ Glycol Ether Solvents
- ECOFAST™ Sustainable Textile Treatment
- Ethyleneamines (EAs), Ethanolamines (EOAs), and Specialty Alkanolamines
- VERSENE™, VERSENEX™, VERSENOL™ Chelants
- ACUMER™ and ACUSOL™ Specialty Polymers
- DOWTHERM™ Fluids

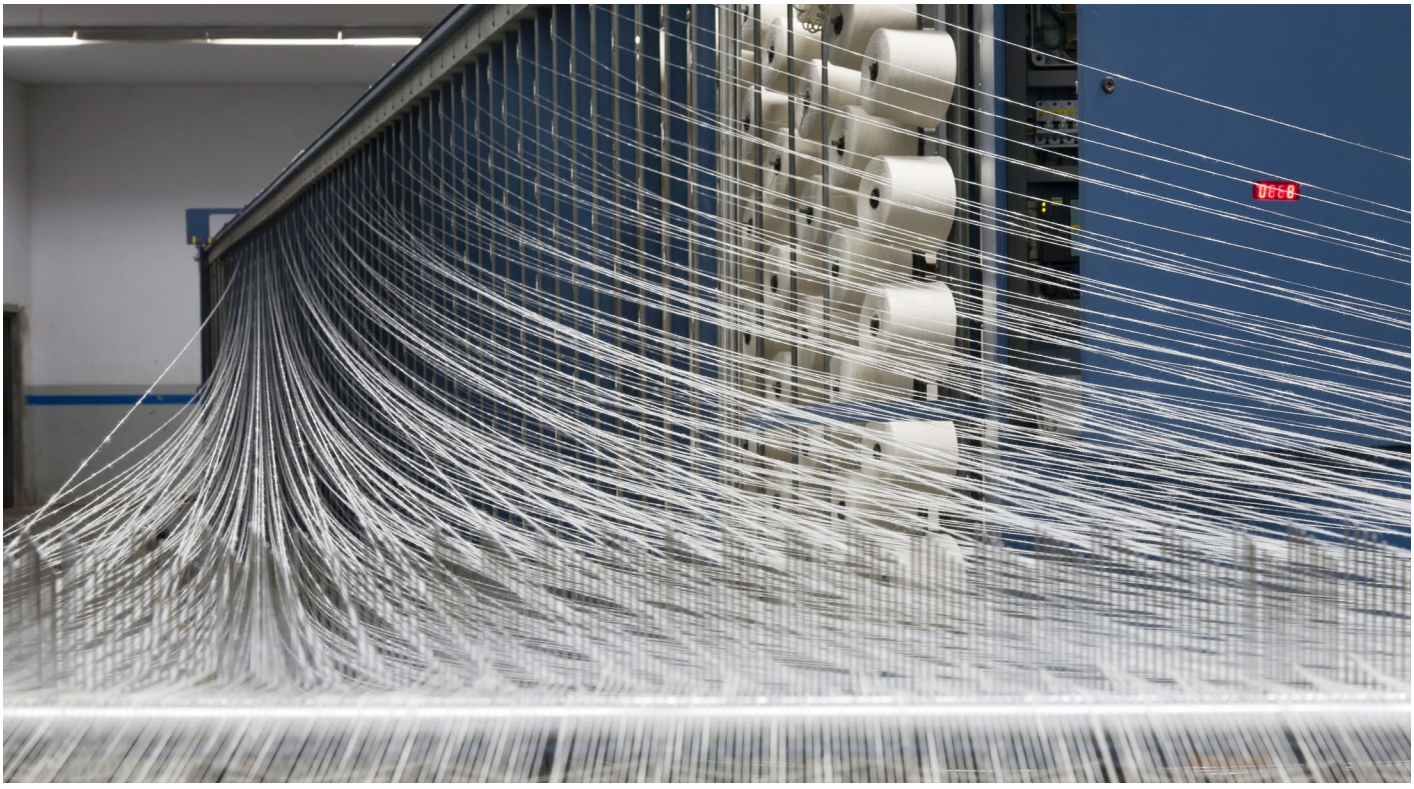
Our products help customers during each key step of textile processing:



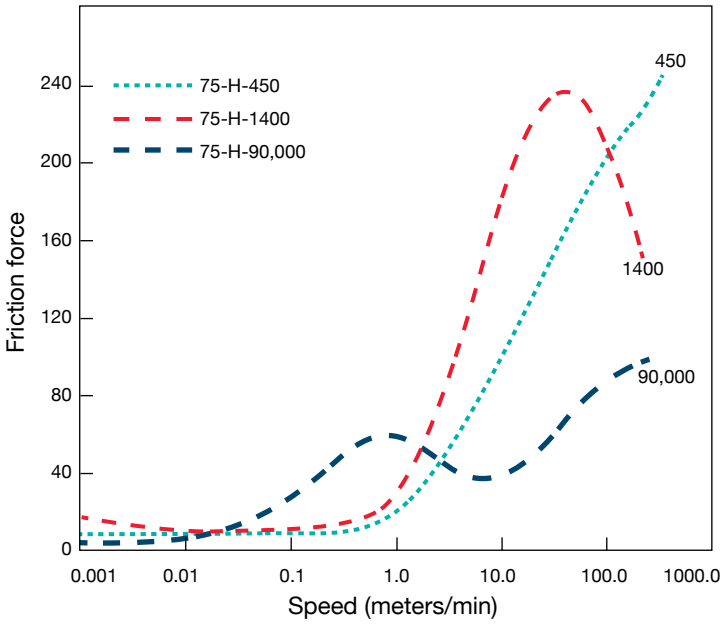
Yarn production/fabric making

High-performance spin finish oil helps lubricant fiber, balances fiber co-efficiency, performs static protection, improves bundle cohesion and assures thermal stability. Dow UCON™/SYNALOX™ base lubricant products greatly improve lubricity of spin finish oil. Other Dow surfactants and polyglycol products can be used as emulsifiers and to improve wetting/penetrating properties.

Dow product recommended	Key attributes or functions
UCON™ 50-HB-170, 50-HB-260, 50-HB-400,50-HB-660 UCON™ 75-H-450, 75-H-1400, 75-H-90000 SYNALOX™ 50-30B, 50-50B	• Fully water soluble, ease of removing in downstream processing • Homogeneous structure, deliver low slide friction • Oxidation stability, less yellowing issue • Clean burn off, low residue on heater surface • Be hygroscopic, help static control
ECOSURF™ SA & EH series TERGITOL™ CA TERGITOL™ 15-S series TRITON™ GR-5M	• Wet the fiber • Emulsify mineral oil and lubricants • Provide lubricity and anti-static function
TERGITOL™ L series DOWFAX™ 63N10, 63N40, DF-141	• Function as emulsifiers, lubricants and defoamers
CARBOWAX™ PEG 400 CARBOWAX™ PEG 600	• Enhance miscibility, stabilize formulation • Equilibrium modifier



Yarn/metal friction properties of UCON™ 75-H Lubricants



150denier/30filament PET yarn is applied

Characteristics of UCON™ 50-HB Lubricant in fiber finishing

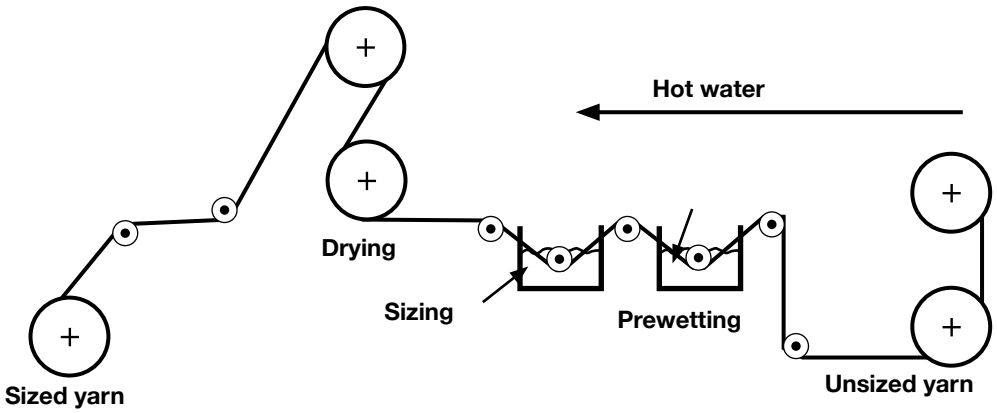
	Yarn-to-metal friction		Yarn-to-yarn	
UCON™ Lubricant	Low speed	High speed	Static generation	Stick-slip[1]
50-HB-55, Inh	Low	Low	Very low	Moderate
50-HB-100	Low	Low	Very low	Moderate
50-HB-170	Low	Moderate	Low	Moderate
50-HB-260	Low	Moderate	Low	Moderate
50-HB-660	Moderate	High	Low	Moderate

[1]The difference between static and kinetic friction

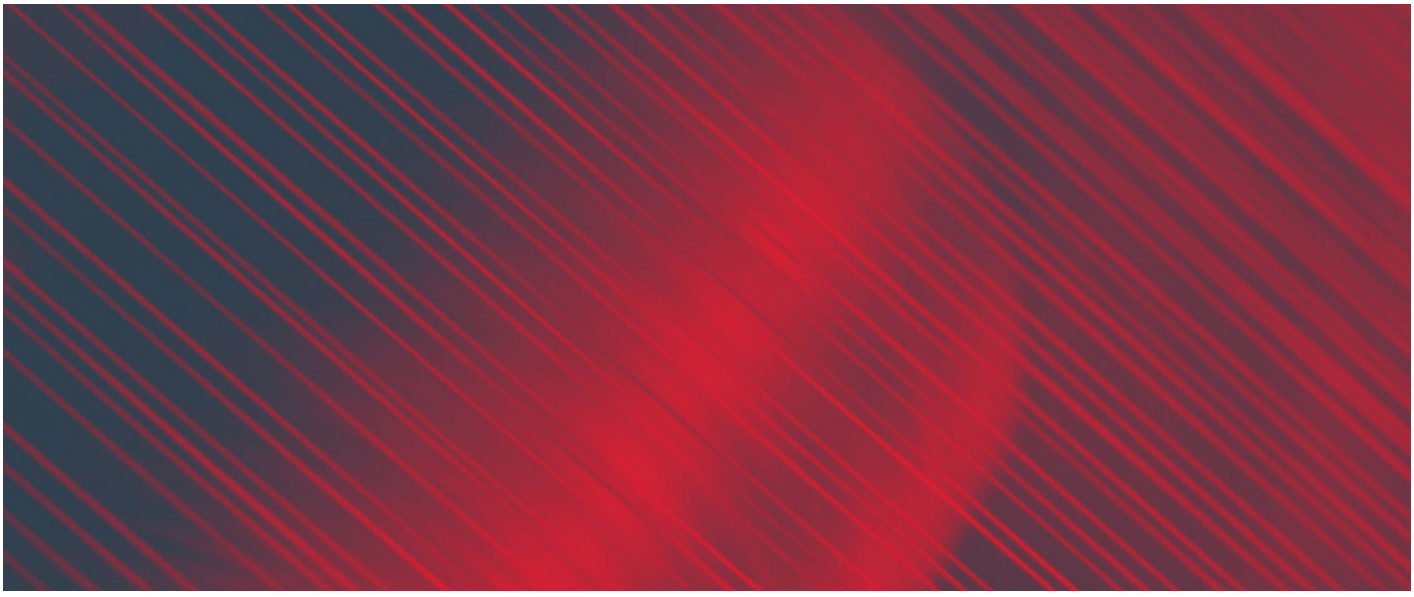
Fabric making

Key Functions of sizing agent

- Decrease hairiness of yarn
- Improve abrasion resistance of yarn
- Reduce breakage of yarn



Dow product recommended	Key attributes or functions
TRITON™ GR-5M TERGITOL™ CA-60, CA-90, 15-S-7, 15-S-9 ECOSURF™ EH-6, EH-9, SA-7, SA-9 DOWFAX™ 2A1, etc	• Wet/penetrate yarn • Emulsify fatty materials • Prevent shrinking or gelling of starch
TERGITOL™15-S TERGITOL™ CA ECOSURF™ SA, EH	• To less or erase static electricity
DOWFAX™ DF DOWFAX™ A or B	• Function as foam control agents



Pretreatment

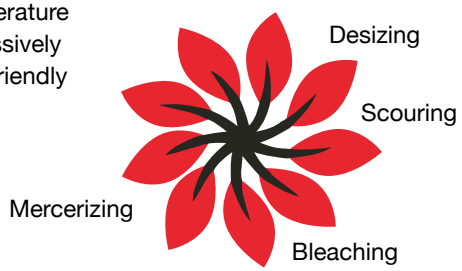
The pretreatment process eliminates sizing agents, oils, waxes, seed hulls, soils, pectin and other impurities, and improves whiteness and feel of the fabric.

A typical pretreatment process includes three steps: de-sizing, scouring and bleaching. Currently, with the trend of short-turn and energy saving processes, some textile mills combine the three steps into two or even one. Therefore, the involved surfactants must have enhanced performance to meet these requirements.

In this application, surfactants play a key role in wetting and penetrating fabric, emulsifying and dispersing impurities, and thus providing effective detergency.

Based on the function requirement and application environment, surfactants used in pretreatment auxiliaries should have the following attributes:

- Compatible with enzymes/hard water/alkaline solutions/ bleaches
- Multi-Functions: detergents/wetting/emulsifying/dispersing/ rinsing aids
- Bare high temperature
- Foam not excessively
- Environmental friendly



Dow product recommended	Key attributes or functions
TERGITOL™ CA-60, CA-90 ECOSURF™ EH-6, EH-9 ECOSURF™ SA-7, SA-9 TERGITOL™ 15-S-7,15-S-9 TERGITOL™ TMN-6,TMN-10	• Wetting • Penetrating • Emulsifying
TRITON™ GR-5M	• Wetting • Penetrating
ECOSURF™ LF-45 TERGITOL™ MINFOAM 1X ECOSURF™ LFE-635	• Low foam wetting • Low foam penetrating
DOWFAX™ 2A1, 8390 DOWFAX ™ AS-801	• High alkaline resistance • Cleaning/Detergency
TRITON™ APG series	• High alkaline resistance • Wetting • Penetrating
DOWFAX™ C6L TRITON™ H-55, H-66, H-11	• Solubilize conventional and low foam nonionic and anionic surfactants

Scouring performance of mixture of TERGITOL™ CA and DOWFAX™ anionic

Scouring agent

Formulation 1~5 is composed of DOWFAX™ 8390 or 2A1, TERGITOL™ CA and Water Benchmark is a popular scouring agent in the market.

Scouring experiment

NaOH(100%): 20g/L
Scouring agent: 2g/L
Bath Ratio: 20
Temperature: 95ºC
Time:1h
Fabric: Knitted cotton/urethane

Scouring results

Scouring agent	Active content	Capillary effect (cm, 5 min, 25°C)	
Formulation 1	~50%	8.0	7.9
Formulation 2	~50%	8.0	8.1
Formulation 3	~50%	7.9	7.9
Formulation 4	~50%	7.8	7.9
Formulation 5	~50%	8.0	7.9
Benchmark	~50%	6.7	7.1

Composition of TERGITOL™ CA and DOWFAX™ anionic are better than benchmark in scouring effects

Dyeing and printing

Dyeing auxiliaries are important for good leveling, uniform, live, and homogenous dyeing

Dyeing auxiliaries	Dye types	Functions
Leveling agents	Reactive dye Dispersing dye	To control the speed of the dyeing process To make dyes on the fabric be uniform
Dispersing agent	Disperse dye Pigment	To disperse insoluble dyes and pigments well in dyeing solutions
Fixing agent	Reactive dye Direct dye Acid dye	To increase functional groups with dyes on fabric, thus to improve wet fastness of fabrics

Leveling agent	
Key attributes or functions	**Dow product recommended**
Promote thorough wetting of the fabric	ECOSURF ™ SA-9, SA-15 TERGITOL ™ 15-S-12,15-S-15
Establish an equilibrium between the dye in the bath, the dye/surfactant micelles, and the dye on the surface of the fiber	TRITON ™ RW-150 DOWFAX ™ 2A1, 8390
Provide foam control, particularly in jet dyeing	DOWFAX ™ DF-112, DF-114 DOWFAX ™ 63N40 TERGITOL ™ L-64

Dispersing agent	
Key attributes or functions	**Dow product recommended**
Disperse well under high temperature	DOWFAX™ 2A1/8390 + ECOSURF™ SA-15 TERGITOL™ XD Other EO/PO copolymer
Improve solubility and dispersion of dyestuffs Enable a better wash-off effectiveness	ACUMER™ 6100, 6200 ACUSOL™ 445N, 479N, 610N

Fixing agent (raw material)	
Key attributes or functions	**Dow product recommended**
Improve wet color fastness Long Roadmap with different categories Dow amines can be as raw material to prepare fixing agent	DEA, TEA EDA, DETA, TEPA AEP

ECOFAST™ Pure sustainable textile treatment —Addressing cotton dyeing challenges

Brighter, bolder, longer, lasting colors

- Brighter hues
- Same shade
- Better color fastness

Unique colors

- Access a new dye class
- Broaden color range

More sustainable operations

- Water
- Dye
- Energy
- Chemicals

Textile printing is the process of applying color (dyes or pigments) to fabrics in a designed way Categories by several ways

Dow product recommended	Key attributes or functions
TERGITOL™ CA-60, CA-90 ECOSURF™ EH-6, EH-9 ECOSURF™ LF-30, LF-45	In pigment paste: • Wetting • Dispersing
DOWFAX™ 2A1, 8390 TERGITOL™ CA-90 ECOSURF™ EH-9, EH-40 TERGITOL™ 15-S-9, 15-S-20, 15-S-30, 15-S-40 DOWFAX™ AS-801	• Emulsifier in printing paste binder • Emulsifier in thickener
ECOSURF™ EH-40 UCON™ EO/PO copolymer	• Stabilizer in printing paste binder
TRITON™ GR-5M ECOSURF™ EH-6, EH-9, SA-7, SA-9 TERGITOL™ CA-60, CA-90 TERGITOL™ 15-S-7, 15-S-9 TRITON™ HW-1000	• Wetting

After-treatment

Textile softener — Basics

- To impart softness and improve wear feeling
- Softener shares a large portion of finishing agent in textiles
- Several softener types, two typical: soft flake (oil) and silicone softener

Dow provides multiple ethyleneamines as raw material to prepare soft flakes/oils

- DETA (Diethylenetriamine)
- AEEA (Aminoethylethanolamine)
- AEP (Aminoethylpiperazine)
- TETA (Triethylenetetramine)
- TEPA (Tetraethylenepentamine)
- HPAx (Heavy polyamine X)

Silicone softener is one of the most important after-treatment agents, which brings fabric products significantly differentiated fabric feel. Dow provides various solutions as emulsifiers or intermediates for silicone softener production.

Silicone type	Key attributes or functions	Dow product recommended
Dimethyl silicone oil Hydroxyl ended silicone oil Amino silicone oil	High emulsification efficiency Good wetting property Good hand feeling of fabric finished Not foam too much	TERGITOL™ TMN-3, TMN-6, TMN-10 TERGITOL™ CA-30, CA-60, CA-90 TERGITOL™ LA-4 ECOSURF™ EH-3, EH-6, EH-9 ECOSURF™ SA-4, SA-7, SA-9
Polyether modified silicone oil	High purity High capped ratio of functional group	APAG/APEG
Linear blocked silicones	Introduce special functional groups	Specialty polyether
	As linkers into the molecular	EDA PIP
	As solvents	Isopropyl alcohol Glycol ether

Silicone emulsions for durable water repellent finishing

A large variety of sport apparel, garments and outdoor equipment's made of diverse textile compositions requires variable water repellency and durable water repellency (DWR), depending on their end uses. Beyond DWR performances, several product attributes are important either for consumer benefits and ease of use or for textile mill smooth operations.

The trends of today's industry toward more certifications on sustainability, safer chemistry uses, and better production practices require more technical options to brand owner designers, formulators, and textile mills. They need materials solutions that reduce environmental impact and engage further in phasing out of existing perfluorinated compounds (PFC's) while delivering on consumer needs.

Dow's silicone-based technologies offer new solutions characterized by their superior durable water repellency and soft hand-feel. Used in combination with crosslinkers and extenders, variable levels of durability and hand-feel can be targeted.

Product	Key features	Softness[1]	Spray test	DWR	Fabrics[2]	Process stability	Tape adhesion	Low cyclics
DOWSIL™ IE-8749 Emulsion	• Durable water repellent • PFC free • No scratch mark, chalking • Stable sewn seam • Soft hand • Highly concentrated • Hydrophilic stain protection • Suitable for all fabrics	+++++	++++	++++	PES, PA	++	+	Yes

These are typical properties, not to be construed as specifications.

[1] All ratings are relative to each other: best = +++++; worst = +.

[2] Results may vary according to the substrate and preferences of the evaluator.

Silicone polymers and emulsions for fabric finishing

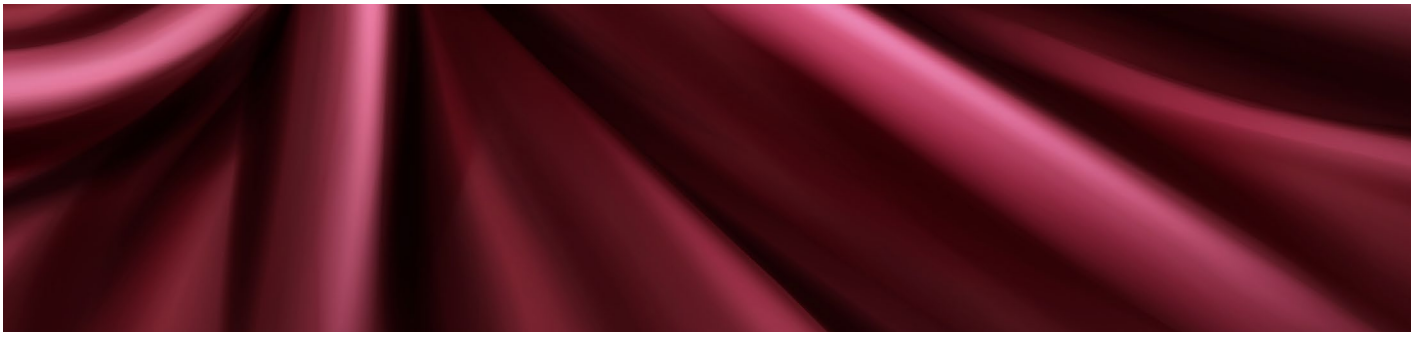
DOWSIL™ and XIAMETER™ Silicone Finishes are widely recognized as the best materials for increasing the softness of fabrics, enhancing their aesthetic feel, and imparting an excellent hand feel. They improve several physical properties, such as tear strength; abrasion and wrinkle resistance; stretch recovery and shrinkage reduction. They can provide either water absorption or water repellency with little-to-no impact on fabric whiteness. They make fabrics more comfortable and more desirable to touch, purchase and wear.

Dow silicone fabric finishes are available in a wide range of chemistries to meet the broadest and the most specific fabric property needs. Amino and amido-functional polymers are one of the most popular forms. Other silicone materials typically used in fabric finishing formulations include hydroxy, methyl hydrogen and epoxy-polyether functionalities. Silicones can be formulated into customized emulsions or blended with organic polymer emulsions to provide a wide variety of performance properties.

Silicones polymers for fabric finishing/softening

Product	Key features	Hand	Type of hand	Low cyclics
XIAMETER™ OFX-8040 Fluid	• Very good softness • Cost-effectiveness • Medium % amino-functional • Micro-emulsifiable	++++	Silky	No
XIAMETER™ OFX-8505 Fluid	• Very good softness • Very good hydrophilicity • Minimal impact on fabric whiteness	+++	Natural	Yes
XIAMETER™ OFX-8630 Fluid	• Premium softness • Very low impact on fabric whiteness • Medium amine %	++++	Silky, bouncy	No
XIAMETER™ OFX-8803 Fluid	• Good softness • Modified amino-functional • Excellent high-shear stability and durable press • Bath compatibility; improved alkaline stability and anionic compatibility	++++	Natural, silky	Yes
XIAMETER™ OFX-8813 Fluid	• Durable softness • Hydrophilic • Very low yellowing • Micro-emulsifiable	++++	Natural	Yes
XIAMETER™ OFX-8822 Fluid	• Premium softness • High amine % • Micro-emulsifiable	+++++	Silky	Yes
DOWSIL™ AP-8041 Fluid **NEW**	• Good softness • Non-yellowing • Suitable for all synthetics & natural fabric • Low amine % • Polymer, micro/macro emulsifiable	+++	Soft	Yes

These are typical properties, not to be construed as specifications.



Silicone emulsions for fabric finishing/softening

Product	Key features	Hand[1]	Type of hand[2]	Low cyclics
DOWSIL™ 8898 Premium Emulsion	• Amino polymer emulsion • Very good softness • Suitable for natural and synthetics, PES micro-fiber “leather” • Good stability	++++	Soft	No
XIAMETER™ MEM-8715 Emulsion	• Reactive silicone polymer emulsion • Good hydrophobicity • Improved durability • Very low yellowing	++++	Soft	No
XIAMETER™ MEM-8031 Emulsion	• Amino+OH polymer emulsion surface modifier, highest slip • Suitable for PES, PES/cotton, cotton, nylon, PES/wool	++++	Silky	No
DOWSIL™ HV 496 Emulsion	• High MW polymer emulsion • Multifunctional benefits • Printed surface feeling modification, softening, non-adhesion	++	Natural	Yes

These are typical properties, not to be construed as specifications.

This document lists DOWSIL™ and XIAMETER™ Silicone Fabric Finishing Polymers and Emulsions available around the world. Additional fabric finishing polymer products may be found online at **www.dow.com /textiles**.

Thermal fluids in textile processing

DOWTHERM™ synthetic organic fluids offer exceptional thermal stability and heat transfer efficiency. This stability can translate into more efficient heat transfer, longer fluid life and optimum operating economics. DOWTHERM™ A and DOWTHERM™ RP are widely used in chemical fiber production including polyester, nylon(polyamide), acrylic and spandex. DOWTHERM™ T is an ideal heating fluid in dye and printing process to ensure consistent product quality.

Dow product recommended	Key attributes or functions
DOWTHERM™ A	• Maximum recommended film temperature 427°C (800°F) • Recommended temperature range in liquid phase operation from 15°C (60°F) to 400°C (750°F) and in vapor phase from 257°C (495°F) to 400°C (750°F) • With low viscosity and freezing point of 12°C (54°F), can be used without steam tracing in installations protected from the weather
DOWTHERM™ RP	• Used in pressure less or low-pressure system • Maximum bulk temperature of 350°C (660°F) and a maximum film temperature of 375°C (710°F) • Degrade primarily to low molecular weight products and can be used to top up other low pressure fluids in some cases
DOWTHERM™ T	• A mixture of C14-C30 alkyl benzene for liquid phase operation in nonpressurized system • Optimum maximum temperature of 288°C (550°F) and can be used to an extended bulk temperature of 316°C (600°F) • Good low temperature properties for low temperature start-up and good thermal stability

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