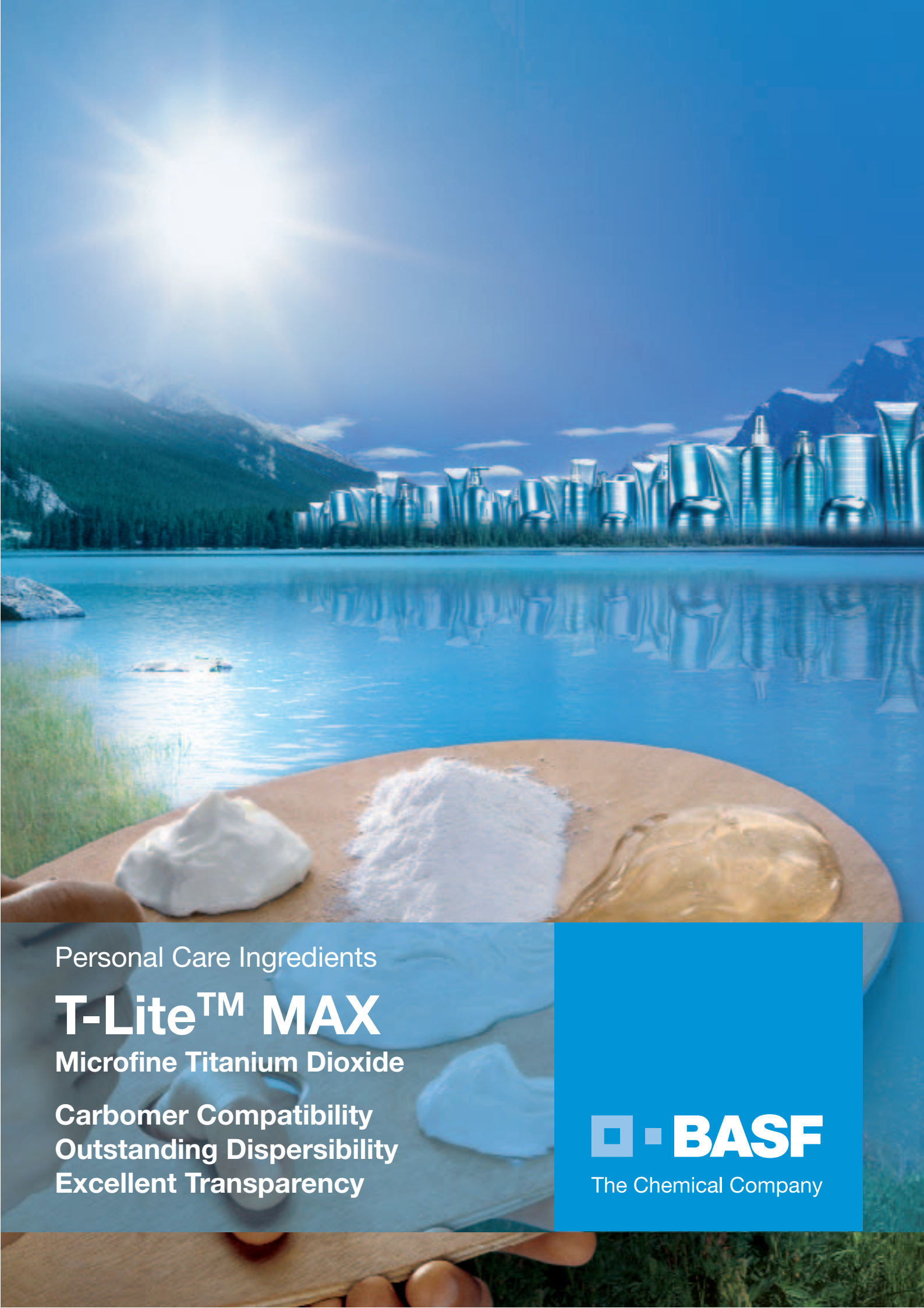


Personal Care Ingredients

T-Lite™ MAX

Microfine Titanium Dioxide

Carbomer Compatibility
Outstanding Dispersibility
Excellent Transparency

BASF
The Chemical Company

T-Lite™ MAX

Microfine Titanium Dioxide

Introduction

T-Lite™ MAX's benefits:

- Carbomer Compatibility
- Outstanding Dispersibility
- Excellent Transparency

Formulation Breakthrough

T-Lite™ MAX is the first carbomer compatible microfine titanium dioxide offering unparalleled formulation stability resulting in improved product aesthetics and a more elegant skin feel.

T-Lite™ MAX is the newest addition to the T-Lite™ product range presenting unparalleled formulation stability with polyacrylate based thickeners. BASF's exclusive carbomer compatible coating increases formulation flexibility, improves formulation aesthetics, and enhances skin sensation. T-Lite™ MAX provides superior UV protection combined with a lightweight skin feel and is the solution for providing daily UV elegance.

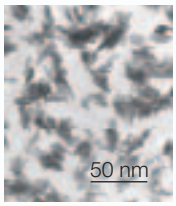
T-Lite™ MAX protects reliably against sunburn and photoaging and is suitable for all types of UV protection products such as daily care, decorative cosmetics, and beachwear. T-Lite™ MAX's carbomer compatibility is especially suited for sophisticated UV protection products offering refined elegance.

Why T-Lite™ MAX?

Today's end consumers want elegant skin care products that are silky, smooth to the touch and offer a lightweight skin feel.

Carbomer thickeners help make this possible, by offering a unique non-tacky and non-slimy skin feel when used in oil in water emulsions. A wide range of viscosities can also be achieved with carbomer, from very fluid to creamy.

Three grades of T-Lite™ to meet specific requirements



Core Material for T-Lite™ Products

T-Lite™ grade products are inorganic UV filters based on microfine titanium dioxide offering photo-stable, broad UVA/UVB protection. They can be used alone or as an effective SPF booster. TiO_2 is non-irritating and is therefore highly recommended for both sensitive skin and childcare products. T-Lite™ is available in three grades:

- T-Lite™ SF offers superior transparency at high product concentrations (up to 10% TiO_2 content).
- T-Lite™ SF-S is the easiest to disperse, allowing for refined formulations at the lowest viscosity for improved fluidity.
- **T-Lite™ MAX** is distinguished by its **unparalleled carbomer compatibility** enabling unprecedented formulation freedom.

T-Lite™ grades are very easy to disperse and are highly compatible with a wide variety of formulation bases such as polar and nonpolar oils, silicones and emulsifiers.

The superior properties of T-Lite™ products generate a superfine distribution of pigment particles resulting in more stable formulations, reliable broad-spectrum UV protection and excellent transparency on the skin.

	T-Lite™ SF	T-Lite™ SF-S	T-Lite™ MAX
INCI	Titanium Dioxide (and) Aluminum Hydroxide (and) Dimethicone / Methicone Copolymer	Titanium Dioxide (and) Hydrated Silica (and) Dimethicone / Methicone Copolymer (and) Aluminum Hydroxide	Titanium Dioxide (and) Dimethoxydiphenylsilane / Triethoxycaprylylsilane Crosspolymer (and) Hydrated Silica (and) Aluminum Hydroxide
Surface treatment	Hydrophobic	Hydrophobic	Polar/Hydrophobic
Hydrophobicity test	Conform	Conform	Nonconform
TiO_2 content	79 – 89 %	73 – 83 %	69 – 73 %
Coating benefits	Provides superior transparency	Very easy to disperse allowing for elegant fluid formulations	Carbomer compatible providing the widest range of formulation possibilities, the best spreading, and a light, non-tacky skin feel
Appearance	Odor-free white powder		
Lattice structure	Rutile		
Crystallite size	14 – 16 nm		
Average particle length	50 nm		
Average particle width	10 nm		
BET	100 m^2/g		
Absorption attributes	SPF Boosting		
UV class	Inorganic UV Filter		
Regulatory status	Approved for use in Japan without dosage limit and up to 25 % of product content in NAFTA (not in combination with avobenzone) and the European Union.		

T-Lite™ MAX

Microfine Titanium Dioxide

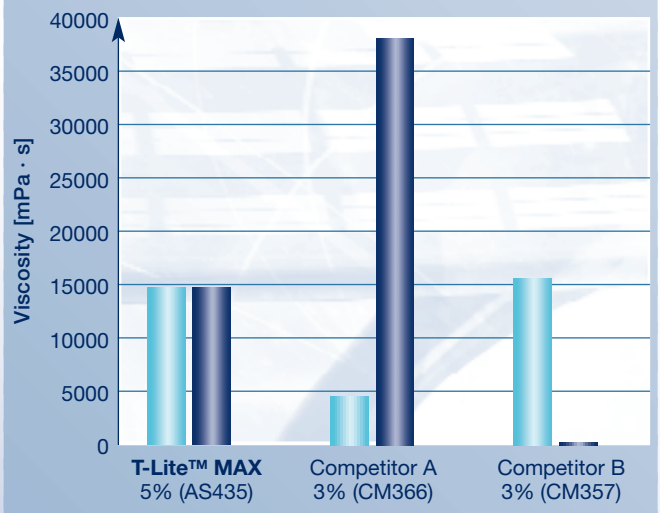
Unparalleled carbomer compatibility

Compatibility with carbomer thickeners (polyacrylate based) enhances skin feel, increases formulation flexibility and potential applications. **T-Lite™ MAX's** superior compatibility with carbomer thickeners enables the creation of consumer products with a desirable texture and an elegant skin sensation.

The remarkable carbomer compatibility of T-Lite™ MAX is shown by measuring formulation viscosity over time for several oil in water formulations consisting of a polyacrylate based thickener in combination with titanium dioxide.

As shown, the systems formulated without T-Lite™ MAX are unstable as their viscosities increase or decrease dramatically over time.

Figure 1: Viscosity profile comparison



24h after preparation	15500	5250	17700
after 3 months	15500	39000	10

Competitor A: Titanium Dioxide, Alumina, Simethicone
Competitor B: Titanium Dioxide, Aluminum Hydroxide, Stearic Acid

Oil in water formulations with 0.3% Carbopol® Ultrez 10 Polymer and the above mentioned titanium dioxides.

T-Lite™ MAX's compatibility with common thickeners

Thickener System	Description of Features & Attributes	Usage level
Carbopol® 940/980	Low use level	0.5
Carbopol® 1342	Low use level	2
Luvigel® EM	Easy to use pre-neutralized liquid	< 3
Carbopol® Ultrez 10 Polymer	Low use level, easier to wet than other Carbopols®	0.3
Carbopol® Ultrez 10 Polymer + Keltrol®	Enhanced stability over Carbopol® Ultrez 10 Polymer alone	0.3 + 0.1
Keltrol®	Universally compatible with TiO_2, high use level, limited formulation flexibility	0.3
Sepiplus 400	Easy to use pre-neutralized liquid	2
Simugel NS	Easy to use pre-neutralized liquid	2
Veegum® + Keltrol®	Universally compatible with TiO_2, high use level, limited formulation flexibility	0.5 + 0.3

T-Lite™ MAX

Microfine Titanium Dioxide

Formulation flexibility

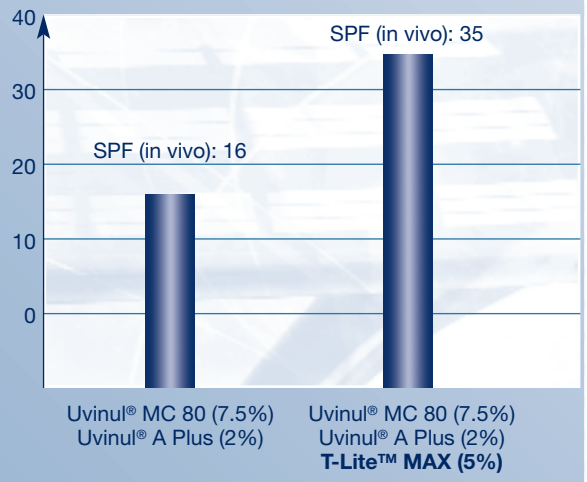
T-Lite™ MAX is highly compatible with a wide variety of formulation bases such as polar and nonpolar oils, silicones, emulsifiers, organic and inorganic UV filters and common antioxidants.

T-Lite™ grades can be used alone to achieve SPF values up to 20 or as an effective SPF booster.

Combinations of T-Lite™ with many other types of UV filters are possible (e.g. Uvinul® MC 80, Uvinul® T 150, Uvinul® A Plus, Z-COTE® MAX, etc.) and due to its rutile lattice structure, T-Lite™ grades show high photo-stability in every type of application.

T-Lite™ grades are also compatible with common antioxidant ingredients (e.g. sodium ascorbyl phosphate, retinol, green tea, etc.) which are often used in UV protection products to help reduce the appearance of skin damage from UV exposure.

Figure 2: T-Lite™ MAX SPF boosting effect



A super homogeneous dispersion allows for an improved SPF boosting effect.

Fluidity & Spreadability: the basis for elegant skin feel

Formulation viscosity directly influences skin sensation. **T-Lite™ MAX** can be formulated at low viscosities with polyacrylate based thickeners for improved fluidity and skin spreadability.

Even at high concentrations (e.g. 8% of TiO_2 content), T-Lite™ MAX formulations remain light and creamy with a non-draggy feel.

And independent of the T-Lite™ MAX concentration, oil in water systems remain in the desired pH range (i.e. 5 - 7.5) and leave a non-greasy and non-sticky feeling on the skin.

T-Lite™ MAX

Microfine Titanium Dioxide

Transparent UVA/UVB protection

Formulations with T-Lite™ grades are distinguished by their excellent transparency. The high transparency results from the small particle size and special surface coating, which renders a superfine stable dispersion in the oil phase of formulations.

Even at 5 % in an O/W emulsion T-Lite™ MAX will be smoother on the skin than competitive products and will spread quickly without leaving white streaks.

Figure 3: T-Lite™ MAX: diluted to 5% in castor oil

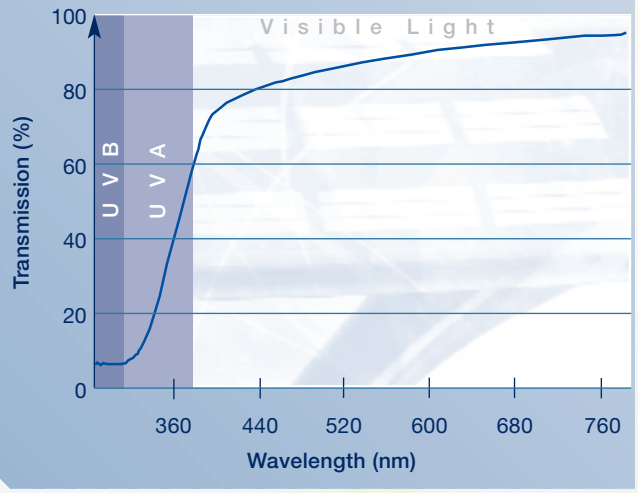
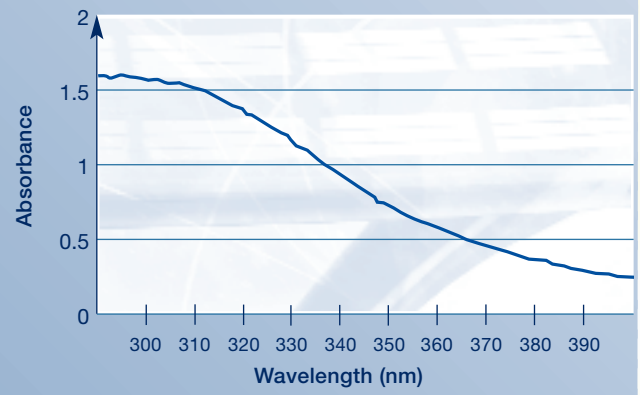
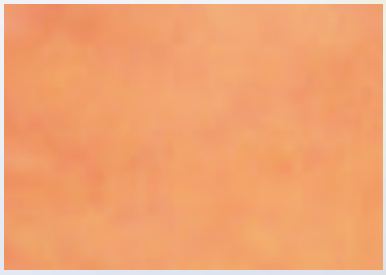


Figure 4: Absorption curve of T-Lite™ MAX





Skin before application

Skin directly after 3 rubs

Skin after 6 rubs

Formulation examples

Beach Sun Lite, BASF Formulation Number: AS435

Phase	%	Product	INCI
A	7.50	Uvinul® MC 80	Ethylhexyl Methoxycinnamate
	2.00	Uvinul® A Plus	Diethylamino Hydroxybenzoyl Hexyl Benzoate
	2.00	Dow Corning® 245	Cyclopentasiloxane
	3.50	Cremophor® A 6	Ceteareth-6, Stearyl Alcohol
	1.50	Cremophor® A 25	Ceteareth-25
	0.50	Beeswax 3044 PH	Bees Wax
	3.00	Lanette® O	Cetearyl Alcohol
	10.00	Miglyol® 812	Caprylic/Capric Triglyceride
B	5.00	T-Lite™ MAX	Titanium Dioxide (and) Dimethoxydiphenylsilane/ Triethoxycaprylylsilane Crosspolymer (and) Hydrated Silica (and) Aluminum Hydroxide
C	ad. 100	Water, dem.	Water
	3.00	Glycerin 87%	Glycerin 87%
	0.30	Abiol	Imidazolidinyl Urea
	1.00	Plantacare® 2000	Decyl Glucoside
	0.30	Carbopol® Ultrez 10 Polymer	Carbomer
	0.04	Triethanolamine Care	Triethanolamine
D	0.50	Euxyl® K 300	Phenoxyethanol, Methylparaben, Butylparaben, Ethylparaben, Propylparaben, Isobutylparaben

Manufacturing: Heat phase A to about 80 °C and homogenize. Give phase B into phase A and homogenize again, for 3 minutes with 11,000 rpm. Heat phase C to about 80 °C and homogenize. Give phase C into the combined phases A/B and homogenize. Cool down while stirring under 40 °C. Add phase D and homogenize again, cool down to room temperature.

Measurement values:

Viscosity (Brookfield SP5):	15,500 mPa·s	pH value:	5.7
SPF (in vivo):	35	SPF (in vivo, COLIPA):	30

Smooth Daily Lite, BASF Formulation Number: CM365

Phase	%	Product	INCI
A	2.00	Lanette® O	Cetearyl Sulfate
	2.00	Finsolv® TN	C12-15 Alkyl Benzoate
	5.00	Miglyol® 812	Caprylic/Capric Triglyceride
	5.00	Cetiol® B	Dibutyl Adipate
	2.00	Amphisol® K	Potassium Cetyl Phosphate
	0.50	Arlacel™ 83	Sorbitan Sequioleat
	3.00	Uvinul® MC 80	Ethylhexyl Methoxycinnamate
B	8.00	T-Lite™ MAX	Titanium Dioxide (and) Dimethoxydiphenylsilane/Triethoxycaprylylsilane Crosspolymer (and) Hydrated Silica (and) Aluminum Hydroxide
C	0.30	Carbopol® Ultrez 10 Polymer	Carbomer
	ad. 100	Water dem.	Water
	0.04	Triethanolamine Care	Triethanolamine
D	0.50	Euxyl® K 300	Phenoxyethanol, Methylparaben, Butylparaben, Ethylparaben, Propylparaben, Isobutylparaben

Manufacturing: Heat phase A to 80 °C. Stir phase B into phase A and homogenize for 3 minutes at 11,000 rpm. Stir homogenized phase C into the combined phases A and B and homogenize. Cool down to about 40 °C and homogenize. Give phase D into phase A + B + C and homogenize.

Measurement values:

Viscosity (Brookfield SP5):	30,800 mPa·s	pH value:	6.1
SPF (in vivo):	13.9	SPF (in vivo, COLIPA):	10

Formulation examples

Anti-Aging Lite, BASF Formulation Number: 53/00427

Phase	%	Product	INCI
A	4.00	Uvinul® A Plus	Diethylamino Hydroxybenzoyl Hexyl Benzoate
	6.00	Uvinul® N 539 T	Octocrylene
	5.00	Luvitol® EHO	Cetearyl Ethylhexanoate
	1.00	Antaron® V-216	PVP/Hexadecene Copolymer
	1.00	Dehymuls® PGPH	Polyglyceryl-2 Dipolyhydroxystearate
	1.00	Hostacerin® DGI	Polyglyceryl-2 Sesquiisostearate
	2.00	Hostaphat® KL 340 N	Trilaureth-4 phosphate
B	3.00	T-Lite™ MAX	Titanium Dioxide (and) Dimethoxydiphenylsilane/Triethoxycaprylylsilane Crosspolymer (and) Hydrated Silica (and) Aluminum Hydroxide
C	ad. 100	Water dem.	Water
	0.30	Carbopol® Ultrez 21 Polymer	Acrylates/C10-30 Alkyl Acrylate Crosspolymer
	5.00	1,2-Propylene Glycol Care	Propylene Glycol
	0.45	Natriumhydroxide 10% in water	Sodium Hydroxide
	0.30	Polysurf® Modified Hydroxyethylcellulose	Cetyl Hydroxyethylcellulose
D	1.00	Euxyl® K 300	Phenoxyethanol, Methylparaben, Butylparaben, Ethylparaben, Propylparaben, Isobutylparaben

Manufacturing: Heat phase A to 80 °C. Stir phase B into phase A and homogenize for 3 minutes at 11,000 rpm. Stir homogenized phase C into the combined phases A and B and homogenize. Cool down to about 40 °C and homogenize. Give phase D into batch and homogenize.

Measurement values:

Viscosity (Brookfield SP5):	7,650 mPa·s	pH value:	6.6
SPF (in vivo):	19	SPF (in vivo, COLIPA):	15

Sensitive Lite, BASF Formulation Number: AS450

Phase	%	Product	INCI
A	6.00	Cetiol® B	Dibutyl Adipate
	8.00	Finsolv® TN	C12-15 Alkyl Benzoate
	8.00	Myritol® 331	Cocoglycerides
	1.00	Lanette® E	Sodium Cetearyl Sulfate
	4.00	Eumulgin® VL 75	Lauryl Glucoside, Polyglyceryl-2 Dipolyhydroxystearate and Glycerin
	2.00	Lanette® O	Cetearyl Alcohol
B	5.00	T-Lite™ MAX	Titanium Dioxide (and) Dimethoxydiphenylsilane/Triethoxycaprylylsilane Crosspolymer (and) Hydrated Silica (and) Aluminum Hydroxide
C	3.00	Glycerin 87%	Glycerin
	0.05	EDTA® BD	Disodium EDTA
	0.20	Allantoin	Allantoin
	0.40	Carbopol® Ultrez 10 Polymer	Carbomer
	ad. 100	Water dem.	Water
	0.04	Triethanolamine Care	Triethanolamine
D	0.50	Glydant®	DMDM Hydantion

Manufacturing: Heat phase A to 80 °C. Stir phase B into phase A and homogenize for 3 minutes at 11,000 rpm. Stir homogenized phase C into the phases A and B and homogenize. Cool down to about 40 °C and homogenize. Give phase D into phase A+B+C and homogenize.

Measurement values:

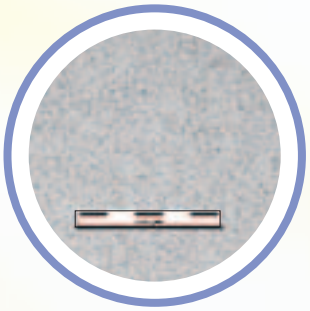
Viscosity (Brookfield SP5):	3,550 mPa·s	pH value:	5.1
SPF (in vivo):	6		

T-Lite™ MAX

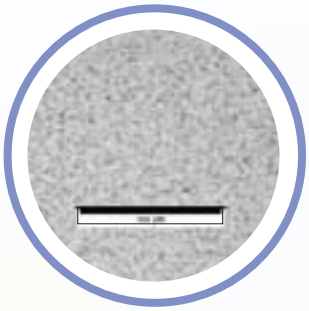
Microfine Titanium Dioxide

Easy to disperse

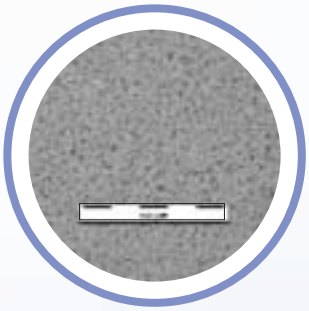
SUPER HOMOGENEOUS Dispersions allow for excellent broad-spectrum UV Protection.
T-Lite™ grades are not restricted with respect to any particular oils or emulsifiers. Simply add T-Lite™ grade products to the final oil phase and apply moderate shear (ca.10,000 rpm) to rapidly produce an extraordinarily homogeneous pre-dispersion without the addition of a dispersing agent.



T-Lite™ MAX Powder dispersed in Uvinul® MC 80, polar
(TiO_2 solids content: 50%)



T-Lite™ MAX Powder dispersed in paraffin oil, nonpolar
(TiO_2 solids content: 30%)



30% Titanium Dioxide, Aluminum Hydroxide, Stearic Acid dispersed in paraffin oil, nonpolar
(TiO_2 solids content: 30%)

Formulation tips

- T-Lite™ products should be directly dispersed in the final oil phase; initially pre-dispersing the pigment in a separate phase is not needed.
- Homogenize T-Lite™ products thoroughly, using a colloid mill or another high-energy system.
- When using several pigments, disperse each pigment separately. Mix first and then add emulsifiers and lastly add the other oil phase components.
- Other titanium dioxide grades are not compatible with carbomers and could possibly show instabilities already after 2 weeks. The true compatibility test should be assessed over a 12-week storage period.
- The level of polyacrylates can be reduced from 0.5 to 0.3% in order to achieve the desired viscosity.
- A concentration level of 0.3% of Carbopol® Ultrez 10 Polymer produces a typical viscosity range from 5000 to 30000 mPas depending on the formulation.
- Luvigel® EM should be used at concentrations below 3%.
- The use of Amphisol® K at concentrations above 2% can lead to formulations with an undesirably high viscosity.
- The use of Luvitol® EHO at concentrations above 15% is not recommended.
- Cyclomethicone and dimethicone are easily formulated with T-Lite™ MAX.

Personal Care Ingredients
Our assortment of personal care ingredients includes UV filters, active ingredients, cosmetic polymers, surfactants and effect pigments. With this range of high quality products, we are the partner of choice of the personal care industry in the areas of hair care, skin and sun care, oral care, shampoos and conditioners, and color cosmetics.

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