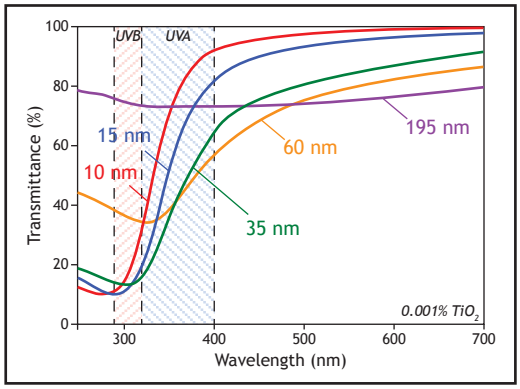
Attenuation Grade TiO_2 Dispersions

Titanium Dioxide (TiO_2) is a well known pigment, because of its high refractive index. It also functions as an effective UV absorber when the primary particle size is under 100 nm.

Titanium Dioxide is ideal for formulating mild or hypoallergenic sun care products for UVA/UVB protection for babies and children, and consumers with sensitive skin. It's the physical and chemical stability of titanium dioxide, which differentiates this filter from organic UV absorbers.
Titanium Dioxide is available in a wide range of primary particle sizes and varying optical properties. However, Titanium Dioxide is not supplied as individual crystals, but as aggregates of primary particles. The degree of aggregation is a function of the primary particle size and manufacturing process. These large aggregates may reduce the protection of the formula against UV light, and likewise scatter visible light, sometimes creating an ashy look when sun care products are applied on skin.

Kobo specializes in the custom formulation and dispersion of TiO_2. We offer a wide selection of Titanium Dioxide dispersions that include various particle sizes, surface treatments, and a wide range of carriers, including volatile solvent bases. Kobo can also provide formulation assistance based on our extensive experience formulating and testing sunscreen products containing inorganic UV filters.

There is a wide range of TiO_2 available with different primary particle sizes (PPS). These pictures compare the transparency of TiO_2 dispersions (at 20% concentration) of various PPS on two different skin types. The small primary particle size Titanium Dioxide dispersion shows high transparency and is also likely to be efficient against UVB light.



This figure shows transmittance curves. The curves show the relationship not only between particle size and transparency, but also between particle size and UVA/UVB balance. As the particle size becomes very small, UVB attenuation is strong but UVA attenuation is weak. The Titanium Dioxide particle size must be in a medium range if balanced protection in both the UVA and UVB regions is desired.

KSL-280A
W/O Milky Sunscreen with TNP50T7-ATB

SPF 27.5 | UVA 8.70 | CW 373

Part 1

• KF-995 - Shin Etsu: *Cyclopentasiloxane*	33.00%
• **TNP50T7-ATB** - Kobo Products: *C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Argania Spinosa Kernel Oil (And) Alumina (And) Hydrogen Dimethicone (And) Tocopheryl Acetate (And) Polyhydroxystearic Acid (And) Bisabolol*	18.03%
• KF-6040 - Shin Etsu: *Cyclopentasiloxane (And) PEG/PPG-18/18 Dimethicone*	3.60%
• Abil® EM 90 - Evonik: *Cetyl PEG/PPG-10/1 Dimethicone*	2.00%
• ELEMENT14 PDMS 20 - Momentive: *Dimethicone*	2.00%
• SF1528 - Momentive: *Cyclopentasiloxane (And) PEG/PPG-20/15 Dimethicone*	0.75%
• **CXG-1101** - Avantor/Kobo Products: *Cyclopentasiloxane (And) Dimethicone/Vinyl Dimethicone Crosspolymer*	0.70%

Part 2

• Deionized Water - *Water*	31.52%
• Butylene Glycol - Ruger Chemical: *Butylene Glycol*	2.80%
• Glycerin U.S.P. Natural 96% - Ruger Chemical: *Glycerin*	1.50%
• Sodium Chloride - Morton Salt: *Sodium Chloride*	0.75%
• Magnesium Sulphate - Mallinckrodt: *Magnesium Sulfate*	0.60%
• Liposorb® L-20 - Vantage: *Polysorbate 20*	0.30%
• Phenoxyethanol - Clariant: *Phenoxyethanol*	0.15%
• ALLANTOIN - ISP: *Allantoin*	0.10%
• Methyl Paraben NF - International Sourcing: *Methylparaben*	0.10%
• Trisodium EDTA - Protameen: *Trisodium EDTA*	0.10%

Part 3

• **MSS-500W** - Kobo Products: *Silica*	2.00%

Manufacturing Procedure

1. Combine all Part 1 ingredients and homogenize until fully dispersed.
2. Combine all Part 2 ingredients and homogenize until fully dispersed.
3. Slowly add Part 2 to Part 1 while homogenizing until homogeneous.
4. Slowly add Part 3 while homogenizing until fully dispersed.

Note: This procedure is cold process.

Description

This sunscreen features Kobo's Titanium Dioxide Dispersion TNP50T7-ATB, an optimized mixture of a TiO_2 sunscreen dispersion with Kobo's Sunboost ATB™, that is a proprietary blend of antioxidants, anti-irritant and anti-iflammatory agents. CXG-1101 imparts a creamy, gel texture to the product, and MSS-500W gives a creamy slip during application.

Carrier/ Solvent	Product Name	INCI Name	Primary Part. Size (nm)	Particle Size** (nm)	Active %	Viscosity
Silicones	CM3K40T4*	*Cyclopentasiloxane (And) Titanium Dioxide (And) PEG-10 Dimethicone (And) Alumina (And) Hydrogen Dimethicone*	15	120	33	pourable
	New CMF655T4*	*Titanium Dioxide (And) Cyclopentasiloxane (And) Polyglyceryl-3 Polydimethylsiloxyethyl Dimethicone (And) Alumina (And) Hydrogen Dimethicone*	15	155	44	pourable
Mixed Solvents	KFS40M170*	*Caprylyl Methicone (And) Titanium Dioxide (And) Cyclopentasiloxane (And) C12-15 Alkyl Benzoate (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone (And) PEG-9 Polydimethylsiloxyethyl Dimethicone*	14	150	32	pourable
	HBTNP60TV*	*Butyloctyl Salicylate (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid*	15	112	50	paste
	New HBTN55TIS-EU*	Butyloctyl Salicylate (And) Titanium Dioxide (And) Isostearic Acid (And) Aluminum Hydroxide (And) C12-15 Alkyl Benzoate (And) Stearic Acid	15	110-150	44	paste
Esters/Oils	TNP50M170*	*C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Hydrogen Dimethicone (And) Polyhydroxystearic Acid*	14	125	39	pourable
	HBP50T7*	*Butyloctyl Salicylate (And) Titanium Dioxide (And) Alumina (And) Hydrogen Dimethicone (And) Polyhydroxystearic Acid*	15	114	39	pourable
	TNP50T7-ATB*	*C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Argania Spinosa Kernel Oil (And) Alumina (And) Hydrogen Dimethicone (And) Tocopheryl Acetate (And) Polyhydroxystearic Acid (And) Bisabolol*	15	118	38	pourable
	OMP50T7*	*Octyldodecyl Myristate (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone*	15	119	40	pourable
	TNP50T7*	*C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone*	15	120	40	pourable
	IN60TIS	*Titanium Dioxide (And) Isononyl Isononanoate (And) Isostearic Acid (And) Aluminum Hydroxide*	15	120	48	paste
	INP60T7*	*Titanium Dioxide (And) Isononyl Isononanoate (And) Alumina (And) Hydrogen Dimethicone (And) Polyhydroxystearic Acid*	15	126	48	pourable
	HBP45M160*	*Butyloctyl Salicylate (And) Titanium Dioxide (And) Alumina (And) Stearic Acid (And) Polyhydroxystearic Acid*	17	192	36	pourable
	TNQP55T5S*	*C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide (And) Polyhydroxystearic Acid*	30	168	45	paste
	New INQP70TMD*	*Titanium Dioxide (And) Isononyl Isononanoate (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone (And) Dimethicone*	35	163	64	pourable
	TNQP50TEL6*	*C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Silica (And) Polyhydroxystearic Acid*	50	190	44	pourable
Natural Esters/Oils	GCP50M170*	*Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone*	14	125	39	pourable
	New GCP45TV*	*Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide (And) Polyhydrostearic Acid*	15	119	36	paste
	JOSP50TJE*	*Simmondsia Chinensis (Jojoba) Seed Oil (And) Titanium Dioxide (And) Aluminum Hydroxide (And) Jojoba Esters (And) Polyhydroxystearic Acid*	15	128	39	paste
	JOSP40TIS	*Simmondsia Chinensis (Jojoba) Seed Oil (And) Titanium Dioxide (And) Aluminum Hydroxide (And) Isostearic Acid (And) Polyhydroxystearic Acid*	15	130	33	pourable
	GCP55TJ*	*Titanium Dioxide (And) Caprylic/Capric Triglyceride (And) Jojoba Esters (And) Polyhydroxystearic Acid*	35	139	52	paste
	GCQP55T5S*	*Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide (And) Polyhydroxystearic Acid*	35	161	45	pourable
Aqueous	New WBG40TWP*	*Water (And) Titanium Dioxide (And) Butylene Glycol (And) Hydrated Silica (And) Ammonium Polyacrylate*	15	188	28	pourable

This table was prepared to assist in formulating with Titanium Dioxide Dispersions. The information contained herein is believed to be accurate at the time of printing and represent typical values, but should not be used as a subsitute for product specification sheets.

**These TiO_2 products comply with the conditions for Titanium Dioxide (nano) as set forth in the Annex VI to Regulation (EC) No 1223/2009.*

***Size in dispersion: intensity-weighted mean size measured on Dynamic Light Scattering particles sizer*

Kobo also offers Dispersions in Volatile Non-D5 Carriers. Please see separate flyer.

Our dispersions are often divided into two general categories:

1. High Solids® Dispersions: These are usually in paste form and have a high active TiO_2 loading and efficacy (up to 5 SPF units/ TiO_2%), which is necessary for formulating for very high SPF.
2. High Speed™ Dispersions: These are usually pourable and easy to incorporate into a formulation. They are highly transparent.

Formulation guidelines

estimation of use level for SPF

10 -15 nm TiO_2 Dispersions

1. SPF < 20 : 2.0-2.5 SPF / % TiO_2
2. SPF > 25 : 2.5-3.0 + SPF / % TiO_2