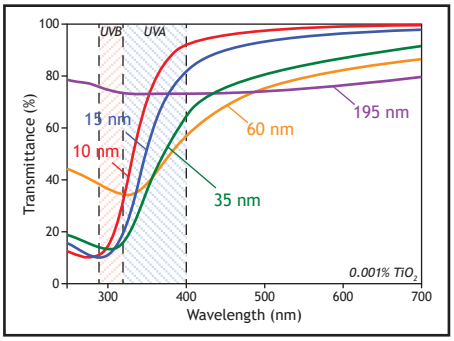
Attenuation Grade
Nano TiO_2 Dispersions

Titanium Dioxide is a mineral UV filter, widely used for UVA and UVB protection, available in a broad range of primary particle sizes and varying optical properties. However, when formulated, it forms aggregates of primary particles; the degree of aggregation is a function of the primary particle size and manufacturing process. Large aggregates reduce the protection of the formula against UV light, and scatter visible light which increases skin whitening when the formula is applied, sometimes creating an ashy look. Kobo uses its extensive experience to offer a wide selection of TiO_2 dispersions that include various particle sizes, surface treatments, and carriers. The products presented here are Nano Titanium Dioxide dispersions, with particle size smaller than 100nm when measured by light scattering sizing, according to the last Nano Guidance from Cosmetics Europe (Interpretation of the Definition of the Term "Nanomaterial" according to the EU Cosmetic Regulation 1223/2009, May 24, 2019).
By carefully selecting carriers and dispersants, these dispersions provide the best protection against UVA and UVB, and minimal whitening. Kobo also provides formulation assistance for development of sunscreen products containing inorganic UV filters.



The transmittance curves in this picture show the relationship not only between particle size and whitening (visible range), but also between particle size and UVA/UVB balance. As the particle size becomes smaller, UVB attenuation is stronger but UVA attenuation is weaker. The Titanium Dioxide particle size must be in a medium range if balanced protection in both the UVA and UVB regions is desired.

These pictures compare the whitening effect of TiO_2 dispersions (at 20% concentration) of various primary particle sizes (PPS) on two different skin types. The small primary particle size Titanium Dioxide dispersions (10 and 15 nm) are the least whitening and are also likely to be the most efficient against UVB light.

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 antioxidant, 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.

Active Ingredients

Titanium Dioxide	6.85%

Carrier	Product Name	INCI Name	Active %	Primary Part. Size (nm)	DLS Size (nm)	EU Compliance	Viscosity
Esters/Oils	INP60T7	*Titanium Dioxide (And) Isononyl Isononanoate (And) Alumina (And) Hydrogen Dimethicone (And) Polyhydroxystearic Acid*	47	15	126	Compliant	Pourable
	TNP50T7	*C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone*	38	15	120	Compliant	Pourable
	GCP50M170	*Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone*	38	15	125	Compliant	Pourable
	INQP70TMD	*Titanium Dioxide (And) Isononyl Isononanoate (And) Polyhydroxystearic Acid (And) Hydrogen Dimethicone (And) Dimethicone*	64	35	163	Compliant	Pourable
Natural Esters/Oils	New NHP55STS	*Titanium Dioxide (And) C13-15 Alkane (And) Stearic Acid (And) Aluminum Hydroxide (And) Polyhydroxystearic Acid*	44	15	N/A	Compliant	Pourable
	GCP45TV	*Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide (And) Polyhydrostearic Acid*	37	15	119	Compliant	Paste
	New GCP51STS	*Caprylic/Capric Triglyceride (And) Titanium Dioxide (And) Alumina (And) Stearic Acid (And) Polyhydroxystearic Acid*	39	15	128	Compliant	Paste
	JOSP40TIS	*Simmondsia Chinensis (Jojoba) Seed Oil (And) Titanium Dioxide (And) Aluminum Hydroxide (And) Isostearic Acid (And) Polyhydroxystearic Acid*	32	15	130	-	Pourable
	JOSP50TJE	*Simmondsia Chinensis (Jojoba) Seed Oil (And) Titanium Dioxide (And) Aluminum Hydroxide (And) Jojoba Esters (And) Polyhydroxystearic Acid*	39	15	128	Compliant	Paste
Silicones	CM3K40T4	*Cyclopentasiloxane (And) Titanium Dioxide (And) PEG-10 Dimethicone (And) Alumina (And) Hydrogen Dimethicone*	32	15	120	Compliant	Pourable
	New CMF640STS	*Cyclopentasiloxane (And) Titanium Dioxide (And) Polyglyceryl-3 Polydimethylsiloxyethyl Dimethicone (And) Aluminum Hydroxide (And) Stearic Acid*	32	15	126	Compliant	Pourable
UV Boosters	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*	38	15	118	Compliant	Pourable
	HBP50T7	*Butyloctyl Salicylate (And) Titanium Dioxide (And) Alumina (And) Hydrogen Dimethicone (And) Polyhydroxystearic Acid*	39	15	114	Compliant	Pourable
	HBTNP60TV	*Butyloctyl Salicylate (And) Titanium Dioxide (And) Stearic Acid (And) Aluminum Hydroxide (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid*	49	15	112	Compliant	Paste
	HBTN55TIS-EU	*Butyloctyl Salicylate (And) Titanium Dioxide (And) Isostearic Acid (And) Aluminum Hydroxide (And) C12-15 Alkyl Benzoate (And) Stearic Acid*	44	15	130	Compliant	Paste
Volatile Non-D5	CAP50M170	*Titanium Dioxide (And) Coconut Alkanes (And) Alumina (And) Hydrogen Dimethicone (And) Polyhydroxystearic Acid*	39	15	125	Compliant	Pourable
	New DIM2F650T4	*Titanium Dioxide (And) Dimethicone (And) Polyglyceryl-3 Polydimethylsiloxyethyl Dimethicone (And) Alumina (And) Hydrogen Dimethicone*	40	15	132	Compliant	Pourable
	MTM3F40T7	*Methyl Trimethicone (And) Titanium Dioxide (And) Alumina (And) Hydrogen Dimethicone (And) Lauryl PEG-9 Polydimethylsiloxyethyl Dimethicone*	31	15	128	Compliant	Pourable
	PM1P70T7	*Titanium Dioxide (And) Isohexadecane (And) Alumina (And) Hydrogen Dimethicone (And) Polyhydroxystearic Acid*	55	15	120	Compliant	Paste
Aqueous	WBG40TWP	*Water (And) Titanium Dioxide (And) Butylene Glycol (And) Hydrated Silica (And) Ammonium Polyacrylate*	25	15	188	Compliant	Pourable

This chart was prepared to assist formulators using TiO_2 Dispersions. The information contained herein is believed to be accurate at the time of printing and represents typical values, but should not be used as a substitute for product specification sheets.

The following information is listed:

- Active content (%)
- Primary Particle Size (nm) of the TiO_2 pigment used
- Size of aggregates as measured by Dynamic Light Scattering - DLS size (nm) - for comparison; should not be utilized for labeling or notification purpose
- EU Compliance: These TiO_2 comply with the conditions for Titanium Dioxide (nano) as set forth in the Annex VI to Regulation (EC) No 1223/2009
- Viscosity

We recommend that customers make their own assessment when using particle size data for the purpose of identifying nanomaterials in their finished formulations.

Please contact our team at ***techservice@koboproductsinc.com*** *for additional information on this subject.*

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

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.

WO 2008067186, JP pending

UV protective cosmetic product incorporating titanium dioxide and transparent iron oxide