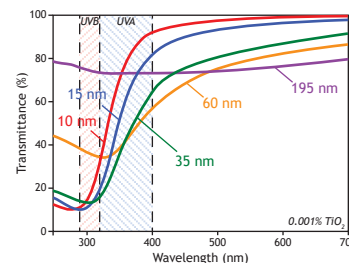


Attenuation Grade Nano TiO₂ Dispersions

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 TiO₂ dispersions that include various particle sizes, surface treatments, and

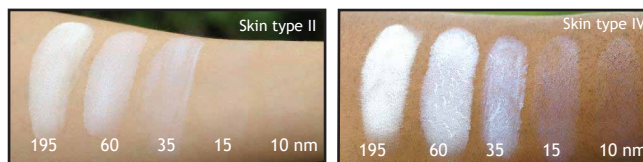
carriers. The products presented here are Nano Titanium Dioxide dispersions, with particle size smaller than 100nm when measured by light scattering sizing, according to the last Nano Guidance from Cosmetics Europe (Interpretation of the Definition of the Term “Nanomaterial” according to the EU Cosmetic 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 TiO₂ 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-462A-EU

Ultra Light Daily UV Defense - Sheer Tint



Part 1

- TNP65MZS - Kobo Products: Zinc Oxide (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid (And) Triethoxycaprylsilane 22.00%
- NHP55STS - Kobo Products: Titanium Dioxide (And) C13-15 Alkane (And) Stearic Acid (And) Aluminum Hydroxide (And) Polyhydroxystearic Acid 18.00%
- Purolan IDD - Lanxess: Isododecane 10.41%
- Dub Zenoat - Stéarinerie-Dubois: Propanediol Dicaprylate 8.00%
- KOBOGUARD® MQ60DM - Kobo Products: Trimethylsiloxysilicate (And) Dimethicone 4.00%
- SunBoost ATB - Kobo Products: Argania Spinosa Kernel Oil (And) Tocopheryl Acetate (And) Bisabolol 4.00%
- KF-6038 - Kobo Products: Lauryl PEG-9 Polydimethylsiloxyethyl Dimethicone 3.00%
- KSG-820 - Shin-Etsu: Lauryl Dimethicone Polyglycerin-3 Crosspolymer (And) Isododecane 2.00%

Part 2

- Garamite 7308 XR - Eckart: Quaternium 90 Sepiolite & Quaternium 90 Montmorillonite 3.00%

Part 3

- Water 13.00%
- Butylene Glycol - Univar/Oxea: Butylene Glycol 5.00%
- Mg Sulfate Hept - Fisher Scientific: Magnesium Sulfate Heptahydrate 1.00%
- SymDiol® 68 - Symrise: 1,2 Hexanediol (and) Caprylyl Glycol 1.00%

Part 4

- MSS-500/N - Kobo Products: Silica 3.00%
- CELLULOBEADS D-10-NPC2 - Kobo Products: Cellulose (And) Hydrogenated Lecithin 2.00%
- DIM2F45TRY - Kobo Products: Dimethicone (And) Iron Oxides (CI 77492) (And) PEG-9 Polydimethylsiloxyethyl Dimethicone (And) Hydrogen Dimethicone (And) Polyglyceryl-4 Isostearate (And) Cetyl PEG/PPG-10/1 Dimethicone (And) Hexyl Laurate 0.40%

- DIM2F50TRR - Kobo Products: Dimethicone (And) Hydrogen Dimethicone (And) Polyglyceryl-4 Isostearate (And) Cetyl PEG/PPG-10/1 Dimethicone (And) Hexyl Laurate 0.14%
- KTZ® EBONY - Kobo Products: Iron Oxides (CI 77499) (And) Mica 0.05%

Manufacturing Procedure

1. Combine Part 1. Add Part 2 to Part 1 under homogenizer, 3000 rpm for 5 minutes to disperse it.
2. Prepare Part 3.
3. Add Part 3 to Parts 1 and 2 under prop stirrer, 1000 rpm.
4. Add Part 4, mix.

Description

A W/SI fluid emulsion designed for daily broad spectrum UV protection characterized by its light-as-air application and the café au lait color. It contains NHP55STS, a natural, pourable, TiO₂ dispersion with 44% active level in combination with TNP65MZS, a larger particle size, pourable, non-nano Zinc Oxide dispersion with 61% active level for high UVB and UVA protection, boosted by SunBoost ATB. The film former KOBOGUARD® MQ60DM is used to help create an even deposition of filters on the skin. KTZ® EBONY, a black pearl, DIM2F50TRR and DIM2F45TRY, red and yellow transparent iron oxide dispersions, are used at low levels to create the café au lait bulk color of the formula, which vanishes upon application, to leave a completely sheer, glowy look, even on darker skin tones. This microplastic-free formula makes use of the slip and ball bearing effect given by MSS-500/N and the softness given by CELLULOBEADS D-10-NPC2 to create a skin feel normally attributed to PMMA.

Active Ingredients

Titanium Dioxide	7.92%
Zinc Oxide	13.42%

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USA

BRASIL

UK

FRANCE

ASIA PACIFIC

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	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) Polyhydroxystearic Acid	37	15	119	Compliant	Paste
	GCP51STS C	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
	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
	NDAP55STS C	Titanium Dioxide (And) C9-12 Alkane (And) Aluminum Hydroxide (And) Stearic Acid (And) Polyhydroxystearic Acid	44	15	101	Compliant	Pourable
	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



C Raw materials approved by COSMOS

C Natural Origin Product

This chart was prepared to assist formulators using TiO₂ 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 TiO₂ 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 TiO₂ 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 TiO₂ 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 TiO₂ loading and efficacy (up to 5 SPF units/ TiO₂%), 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

UV protective cosmetic product incorporating titanium dioxide and transparent iron oxide

KOBO

TiO₂ Dispersions

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