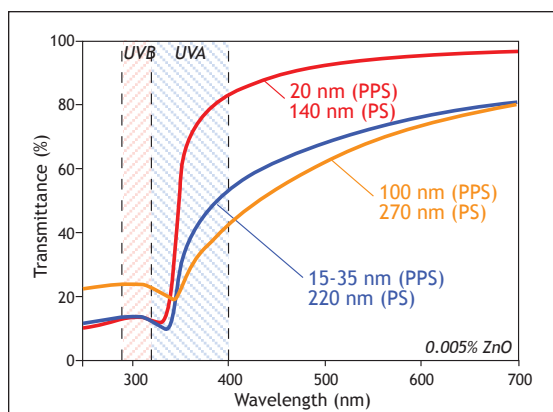


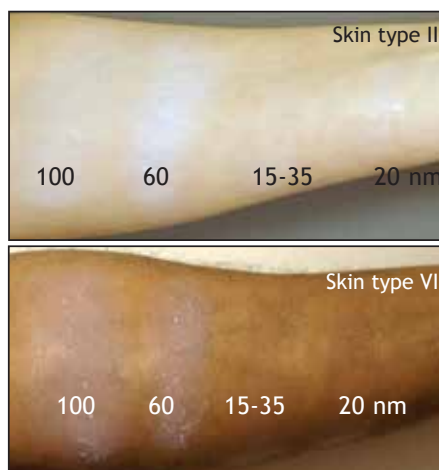
Attenuation Grade ZnO Dispersions

Zinc Oxide is used in cosmetics primarily as a skin protectant and for UV attenuation. It is ideal for formulating mild or hypoallergenic sun care products for UVA/UVB protection for babies and people with sensitive skin. Zinc Oxide is available in a wide range of primary particle sizes and varying optical properties. Notwithstanding, zinc oxide is not supplied as individual grains, but as aggregates of primary particles. The degree of aggregation is a function of the primary particle size and manufacturing process, similar to the case with TiO₂. These large aggregates may

reduce the protection of the formula against UV light, and likewise scatter visible light, increasing whitening when sun care products are applied on skin. Kobo specializes in the custom formulation and dispersion of zinc oxide. We offer a wide selection of ZnO 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.



This figure shows transmittance curves. The curves indicate the relationship between particle size, transparency and UVA/B attenuation. As the particle size becomes very small, ZnO can be effective in UVB attenuation (up to 2 SPF / ZnO%) but it can lose some UVA protection. Like TiO₂, the particle size should be optimized when balanced protection of UVA and UVB light is required.



The primary particle size available on the market ranges from 20 to 120 nm. Dispersions with various particle sizes can be made. These pictures compare the transparency of ZnO dispersions of various PPS when applied on two different skin types.

Elegant W/O Sunscreen featuring TNP50T7 & TNP65FZS SPF 44 PFA 16

Formula KSL-179C-CH

Part 1

- Deionized Water 28.40%
- Sodium Chloride - Morton Salt 0.50%
- Aculyn™ 44 - Rohm & Haas: PEG-150/Decyl Alcohol/SMDI Copolymer 0.50%
- Allantoin - DSM Nutritional Products Allantoin 0.20%

Part 2

- Butylene Glycol - Ruger Chemical Co., Inc.: Butylene Glycol 2.00%
- KELTROL® CG - CP Kelco: Xanthan Gum 0.10%

Part 3

- TNP50T7 - Kobo Products: C12-15 Alkyl Benzoate (And) Titanium Dioxide (And) Alumina (And) Polyhydroxystearic Acid (And) Methicone 32.00%
- TNP65FZS - Kobo Products: Zinc Oxide (And) C12-15 Alkyl Benzoate (And) Triethoxycaprylylsilane (And) Polyhydroxystearic Acid 30.00%
- ABIL® EM 90 - Evonik: Cetyl PEG/PPG-10/1 Dimethicone 3.00%
- SF1214 - Momentive: Cyclopentasiloxane (And) Dimethicone 2.00%
- Tocopherol - BASF: Tocopherol 0.30%

- Methyl Paraben NF - International Sourcing: 0.15% Methylparaben
- Propyl Paraben NF - International Sourcing: 0.10% Propylparaben

Part 4

- MSS-500W - Kobo Products: Silica 0.75%

Manufacturing Procedure

1. Combine Part 1 and heat to 70°C.
2. Add Part 2 to Part 1.
3. Combine Part 3 and heat to 70°C.
4. Combine Parts 1 and 2 to Part 3 while propeller mixing.
5. Add Part 4 while cooling.

Description

Elegant W/O sunscreen that uses Kobo's Titanium Dispersion, TNP50T7, and Kobo's Zinc Oxide Dispersion, TNP65FZS. MSS-500W Spherical Silica gives slip during application and reduces shine on the skin.

Active Ingredient(s): Titanium Dioxide 12.32%
Zinc Oxide 18.72%

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ZnO Dispersions

Carrier / Solvent	Product Name	INCI Name	Primary Part. Size	Particle Size**	Active %	Viscosity
Silicones	New CMF650ZSI*	Zinc Oxide (And) Cyclopentasiloxane (And) Polyglyceryl-3 Polydimethylsiloxyethyl Dimethicone (And) Triethoxycaprylylsilane	20 nm	157 nm	48	Pourable
	CM3K65FZS*	Zinc Oxide (And) Cyclopentasiloxane (And) PEG-10 Dimethicone (And) Triethoxycaprylylsilane	60 nm	228 nm	60	Paste
Mixed Solvents	KES50ZSM	Zinc Oxide (And) Ethyl Trisiloxane (And) Cyclopentasiloxane (And) Methicone (And) Lauryl PEG-9 Polydimethylsiloxyethyl Dimethicone	25 nm	190 nm	48	Pourable
Esters/Oils	TNP70MZ	Zinc Oxide (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid (And) Isopropyl Titanium Triisostearate	15-35 nm	200 nm	68	Pourable
	INH73MZ	Zinc Oxide (And) Isononyl Isononanoate (And) Polyglyceryl-6 Polyricinoleate (And) Isopropyl Titanium Triisostearate	15-35 nm	200 nm	71	Paste
	TNP65MZS*	Zinc Oxide (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	15-35 nm	221 nm	63	Pourable
	New HBTNP60ZSI*	Zinc Oxide (And) Triethoxycaprylylsilane (And) Butyloctyl Salicylate (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid	20 nm	128 nm	58	Pourable
	TNP50ZSI*	C12-15 Alkyl Benzoate (And) Zinc Oxide (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	20 nm	130 nm	47	Pourable
	INP70ZSI*	Zinc Oxide (And) Isononyl Isononanoate (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	20 nm	135 nm	68	Pourable
	New OPP60ZSI*	Zinc Oxide (And) Ethylhexyl Palmitate (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	20 nm	173 nm	58	Pourable
	New TNSS60MZSI*	Zinc Oxide (And) Ethylhexyl Methoxycrylene (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	35 nm	171 nm	58	Paste
	TNHLP70FZS*	Zinc Oxide (And) Hydrogenated Polyisobutene (And) C12-15 Alkyl Benzoate (And) Triethoxycaprylylsilane (And) Polyhydroxystearic Acid	60 nm	207 nm	67	Pourable
	HBQP75FZS*	Zinc Oxide (And) Butyloctyl Salicylate (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	60 nm	212 nm	72	Pourable
TNP65FZS*	Zinc Oxide (And) C12-15 Alkyl Benzoate Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	60 nm	238 nm	62	Paste	
Natural Esters/Oils	COP50MZ	Zinc Oxide (And) Ricinus Communis (Castor) Seed Oil (And) Polyhydroxystearic Acid (And) Isopropyl Titanium Triisostearate	15-35 nm	210 nm	49	Pourable
	CO55MZJ*	Zinc Oxide (And) Ricinus Communis (Castor) Seed Oil (And) Jojoba Esters	15-35 nm	292 nm	52	Paste
	SO60MZJ*	Zinc Oxide (And) Helianthus Annuus (Sunflower) Seed Oil (And) Jojoba Esters	15-35 nm	371 nm	57	Paste
	JOSP55XZJ*	Zinc Oxide (And) Simmondsia Chinensis (Jojoba) Seed Oil (And) Polyhydroxystearic Acid (And) Jojoba Esters	20 nm	200 nm	52	Paste
	GCP50ZSI*	Zinc Oxide (And) Caprylic/Capric Triglyceride (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	20 nm	130 nm	47	Pourable
	GCP45XZJ*	Caprylic/Capric Triglyceride (And) Zinc Oxide (And) Polyhydroxystearic Acid (And) Jojoba Esters	20 nm	155 nm	43	Pourable
	GCP50XZ4	Zinc Oxide (And) Caprylic/Capric Triglyceride (And) Polyhydroxystearic Acid (And) Methicone	20 nm	155 nm	48	Pourable

This table was prepared to assist in formulating with Zinc Oxide 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 substitute for product specification sheets.

* These ZnO products comply with the conditions for Zinc Oxide (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 ZnO loading and efficacy.
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

- | | |
|----------------------------------|-----------------------|
| 1. PPS : 20 - 30 nm, PS < 150 nm | 1.0 - 2.0 SPF / ZnO % |
| 2. PPS : > 60 nm, PS > 200 nm | 0.5 - 1.0 SPF / ZnO % |

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