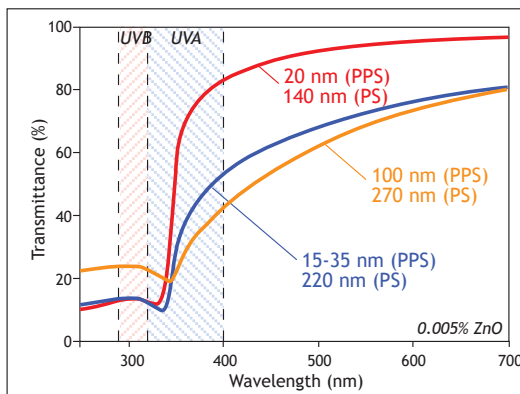


# Attenuation Grade ZnO Dispersions



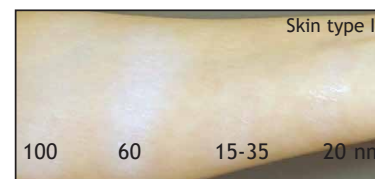
Zinc Oxide is a mineral UV filter, available in a wide range of primary particle sizes and varying optical properties. However, when formulated, it forms aggregates of primary particles; the degree of aggregation is a function of the primary particle size and manufacturing process. Large aggregates reduce the protection of the formula against UV light, and scatter visible light which increases skin whitening when the formula is applied.

Kobo uses its extensive experience to offer a wide selection of ZnO dispersions that include various particle sizes, surface treatments, and carriers. 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 between particle size, whitening (visible range) and UVA/UVB attenuation. As the particle size becomes smaller, ZnO becomes more effective in UVB attenuation (up to 2 SPF / ZnO%) and less in UVA protection. Particle size should be optimized when balanced UVA/UVB protection is required.

These pictures compare the whitening effect of ZnO dispersions (at 20% concentration) of various primary particle sizes (PPS) on two different skin types.



## KSL-384B All Zinc Sunscreen



### Part 1

- **TNP70MZ** - Kobo Products: Zinc Oxide (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid (And) Isopropyl Titanium Triisostearate 19.50%
- **TNP70ZSI** - Kobo Products: Zinc Oxide (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane 15.94%
- Dermal 25B - Alzo International Inc.: C12-15 Alkyl Benzoate 4.41%
- BRB Caprylyl Methicone - BRB International: Caprylyl Methicone 3.00%
- Dowsil™ ES-5226 DM Formulation Aid - Dow Chemical: Dimethicone (and) PEG/PPG-18/18 Dimethicone 3.00%
- Xiameter™ PMX-200 Silicone Fluid 100 CS - Dow Chemical: Dimethicone 2.00%
- Abil® WE 09 - Evonik: Polyglyceryl-4 Isostearate (And) Cetyl PEG/PPG-10/1 Dimethicone (And) Hexyl Laurate 1.75%
- Abil® EM 180 - Evonik: Cetyl PEG/PPG-10/1 Dimethicone 1.00%

### Part 2

- **Plandool™-G** - Nippon/Kobo Products: Bis-Behenyl/Isostearyl/Phytosteryl Dimer Dilinoleyl Dimer Dilinoleate 0.75%
- Pelemol® GTB - Phoenix Chemical: Tribehenin 0.50%

### Part 3

- Deionized Water - Water 32.40%

### Part 4

- Glycerin U.S.P. F.C.C. 96% - Ruger Chemical: Glycerin 6.00%
- Keltrrol® CG - CP Kelco: Xanthan Gum 0.10%

### Part 5

- Magnesium Sulfate - Fisher Scientific: Magnesium Sulfate 0.90%
- ALLANTOIN - RITA: Allantoin 0.15%
- Dermofeel® PA-3 - Dr. Straetmans/Kinetik: Sodium Phytate (And) Aqua (And) Alcohol 0.15%

### Part 6

- Symdiol® 68 - Symrise: 1,2-Hexanediol (And) Caprylyl Glycol 0.50%
- SymSave® H - Symrise: Hydroxyacetophenone 0.50%

### Part 7

- **MSS-500W** - Kobo Products: Silica 5.45%
- **MSS-500/N** - Kobo Products: Silica 2.00%

### Manufacturing Procedure

1. In main vessel, combine Part 1 and homogenize (4800 rpm) while heating to 80-85 °C.
2. Once Part 1 reaches a temperature of 80-85 °C, add Part 2 and homogenize for an additional 10 minutes.
3. In a side kettle, add Part 3. Pre-mix Part 4 and add to Part 3 with fast speed propeller mixing. While mixing, heat Parts 3 and 4 to 80 °C.
4. Add Part 5 ingredients, one at a time, to Parts 3 and 4 with fast speed propeller mixing. (Maintain temperature at 80 °C).
5. Slowly add Parts 3, 4 and 5 to Parts 1 and 2 with slow homogenization. Slowly homogenize with side scraping only enough to blend contents thoroughly.
6. When all of the water phase is added, begin cooling batch while homogenizing (3500 rpm).
7. Pre-mix Part 6 until phase is clear and all is dissolved. When batch reaches 40 °C, add Part 6 with slow homogenization.
8. Sprinkle in Part 7 and homogenize until batch is smooth and uniform.
9. When batch reaches 30 °C, homogenize at moderate speed for 15 minutes, maintaining the temperature at 30 °C or less.

### Description

This formula is a rich and creamy sunscreen that glides on easily and rubs in leaving very minimal whitening on skin. Skin is left feeling soft and moist, yet non-greasy. The different particle sizes of Zinc Oxide dispersions TNP70MZ and TNP70ZSI provide the SPF and high UVA protection. Plandool™-G helps provide a water-resistant film while also offering skin moisturization. Kobo microspheres MSS-500W and MSS-500/N give the product its soft and non-greasy after feel.

### Active Ingredients

Zinc Oxide 24.06%

### Testing

SPF: in vivo on 3 subjects  
UVA-PF: in vivo on 3 subjects  
CW: FDA method












**KOBO**

USA - New Jersey  
+1 (908) 757-0033

BRASIL - São Paulo  
+55 (11) 5062-0634

UK - Abingdon  
+44 7913 636 673

FRANCE - Labège  
+33 (0)5-62-88-77-40

Carrier	Product Name	INCI Name	Active %	Primary Part. Size (nm)	DLS Size (nm)	EU Compliance	Viscosity
Esters/Oils	TNP50ZSI	C12-15 Alkyl Benzoate (And) Zinc Oxide (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	47	20	N/A	Compliant	Pourable
	OMQP50XZ4	Zinc Oxide (And) Octyldodecyl Myristate (And) Polyhydroxystearic Acid (And) Methicone	48	20	N/A	-	Pourable
	GCP50XZ4	Zinc Oxide (And) Caprylic/Capric Triglyceride (And) Polyhydroxystearic Acid (And) Methicone	48	20	155	-	Pourable
	GCP50ZSI	Zinc Oxide (And) Caprylic/Capric Triglyceride (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	47	20	130	Compliant	Pourable
	 TNQP75HP1	Zinc Oxide (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	73	60-100	216	Compliant	Paste
Natural Esters/Oils	 GCP55ZSG 	Zinc Oxide (And) Caprylic/Capric Triglyceride (And) Polyhydroxystearic Acid (And) Stearoyl Glutamic Acid	52	20	125	Compliant	Pourable
	GCP55MZ8SG 	Zinc Oxide (And) Caprylic/Capric Triglyceride (And) Polyhydroxystearic Acid (And) Stearoyl Glutamic Acid	52	35	180	Compliant	Pourable
	 NHP60MZ8SG 	Zinc Oxide (And) C13-15 Alkane (And) Stearoyl Glutamic Acid (And) Polyhydroxystearic Acid	57	35	135	Compliant	Pourable
Silicones	CM3K50XZ4	Zinc Oxide (And) Cyclopentasiloxane (And) PEG-10 Dimethicone (And) Methicone	48	20	N/A	-	Pourable
	CM3KG60XZ4	Zinc Oxide (And) Cyclopentasiloxane (And) PEG-10 Dimethicone (And) Hydrogen Dimethicone (And) Lauryl Polyglyceryl-3 Polydimethylsiloxyethyl Dimethicone	57	20	N/A	-	Pourable
	 CMF650ZSI	Zinc Oxide (And) Cyclopentasiloxane (And) Polyglyceryl-3 Polydimethylsiloxyethyl Dimethicone (And) Triethoxycaprylylsilane	48	20	157	Compliant	Pourable
UV Boosters	 HBTNP60ZSI	Zinc Oxide (And) Triethoxycaprylylsilane (And) Butyloctyl Salicylate (And) C12-15 Alkyl Benzoate (And) Polyhydroxystearic Acid	58	20	128	Compliant	Pourable
Volatile Non-D5	 CAQP60ZSI	Zinc Oxide (And) Coconut Alkanes (And) Triethoxycaprylylsilane (And) Polyhydroxystearic Acid (And) Coco-Caprylate/Caprates	58	20	133	Compliant	Pourable
	 DMTMF50ZSI	Zinc Oxide (And) Dimethicone (And) PEG-9 Polydimethylsiloxyethyl Dimethicone (And) Triethoxycaprylylsilane	48	20	180	Compliant	Pourable
	MTM3K50XZ4	Zinc Oxide (And) Methyl Trimethicone (And) PEG-10 Dimethicone (And) Methicone	48	20	170	-	Pourable
	 PM9QP60ZSI	Zinc Oxide (And) Isododecane (And) Polyhydroxystearic Acid (And) Triethoxycaprylylsilane	58	20	145	Compliant	Pourable

This chart was prepared to assist formulators using ZnO 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 ZnO 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 ZnO comply with the conditions for Zinc Oxide (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](mailto:techservice@koboproductsinc.com) for additional information on this subject.

### 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 %

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.

US 20180235855A1, WO 2007048057A3

Zinc Oxide powder blends, their production and use.

US 9949904B2

Method of Formulating ZnO powder blends for balanced UVA/UVB attenuation.

**KOBO**

ZnO Dispersions

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