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# *Pigment Surface Treatment*

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*By: Yun Shao*

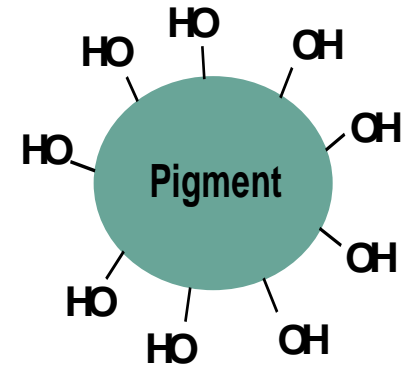
Technical Seminar  
April 14, 2008

**KOBO**  
[www.koboproducts.com](http://www.koboproducts.com)

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# *Need for Surface Modification*

Most pigments have hydrophilic surface that contains polar hydroxyl groups and adsorbed moisture.

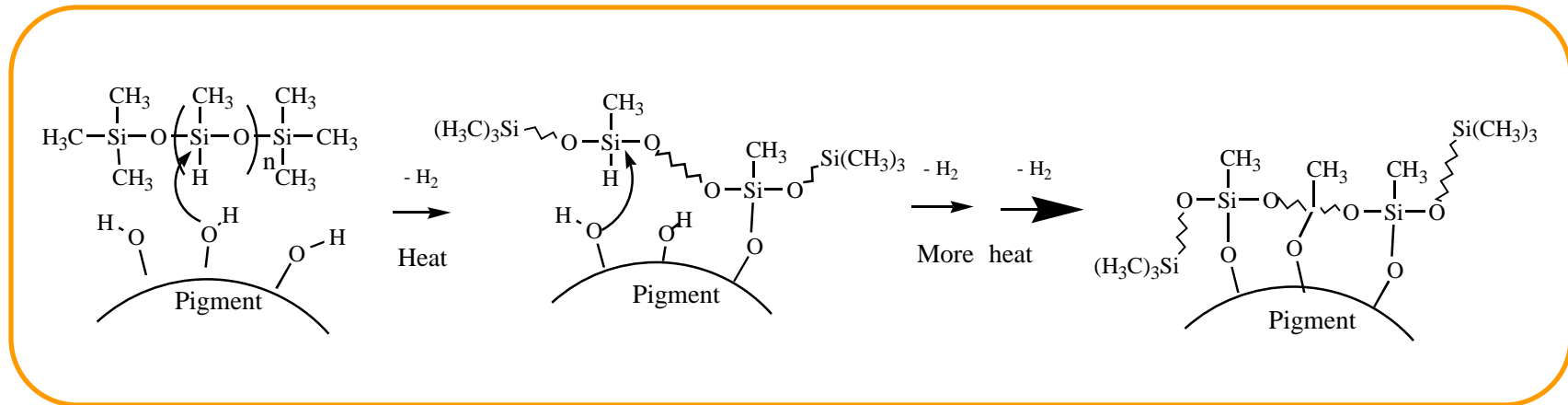


- Agglomeration of particles poor skin feel
- Poor wettability and dispersibility in cosmetic fluids
- Poor dispersion stability and poor formulation stability
- Poor pressability in pressed powder
- Poor chemical stability of metal oxides

## **Surface treatment**

can improve the performance of a pigment in all the above aspects.

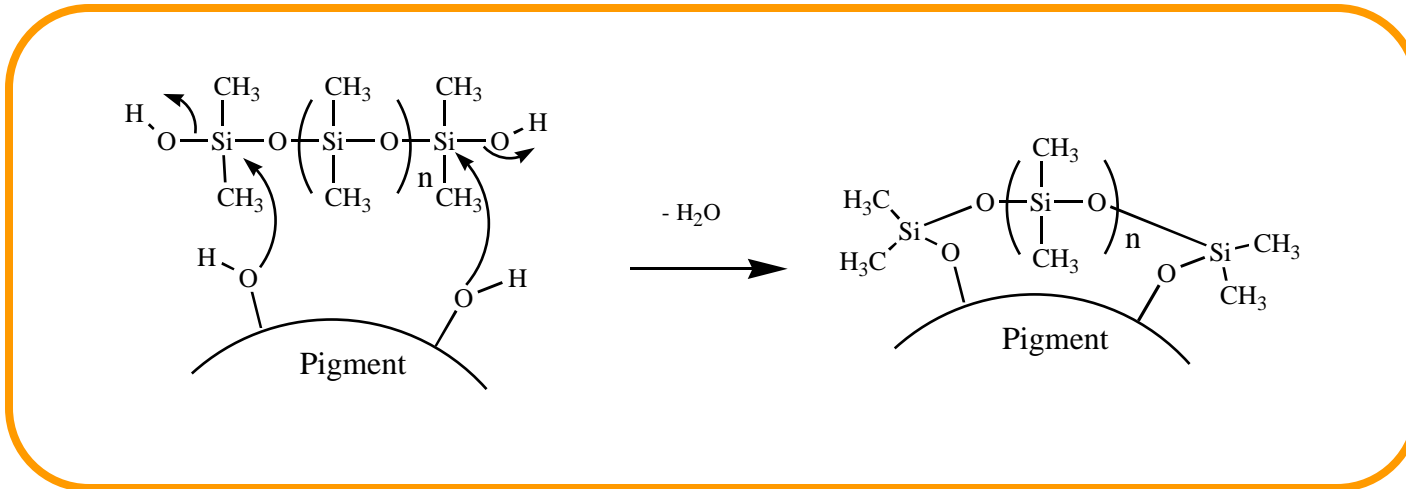
# Methicone (MS)



## Properties:

- Crosslinked coating layer. Very hydrophobic; stable at pH of 3 - 9
- Skin feel is somewhat dry
- Good for wet/dry powder formulation
- Good for W/Si emulsion
- Not very compatible with esters and oils. Not good for O/W emulsion

# Dimethicone (DS)



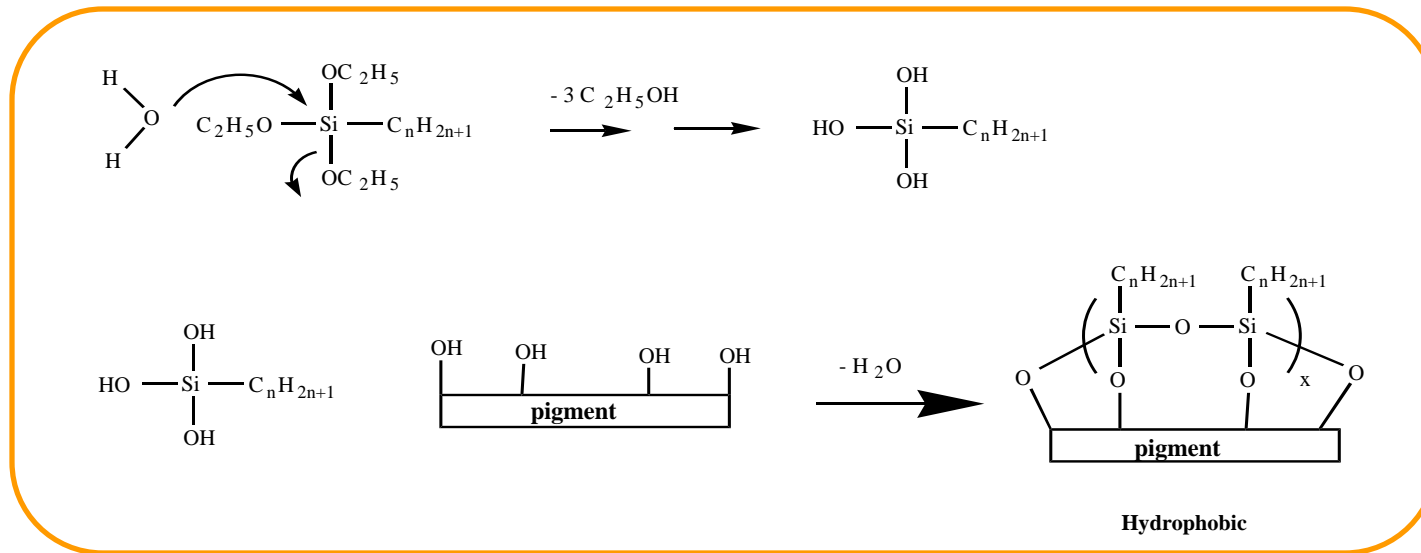
## Properties:

- Have good slip and a more lubricious feel than methicone
- No Hydrogen potential
- Less hydrophobic than methicone
  
- Good for wet/dry powder formulation
- Good for W/Si emulsion

# *Methicone and Dimethicone Treated Pigments*

<b>Substrate</b>	<b>Methicone</b>	<b>Dimethicone</b>
Anatase P-TiO <sub>2</sub>	BTD-MS2	BTD-DS4
Rutile P-TiO <sub>2</sub>	RBTD-MS2	RBTD-DS4
Red Iron oxide	BXRO-MS2	BRO-DS3
Yellow Iron oxide	BXYO-MS2	BYO-DS3
Black Iron oxide	BXBO-MS2	BBO-DS3
Mica	GMS-MS3	
Talc	Talc N-MS2	
Micronized TiO <sub>2</sub>	(TTO-MS4)	
Micronized ZnO	(ZnO XZ-MS4)	

# Triethoxycaprylylsilane (11S)



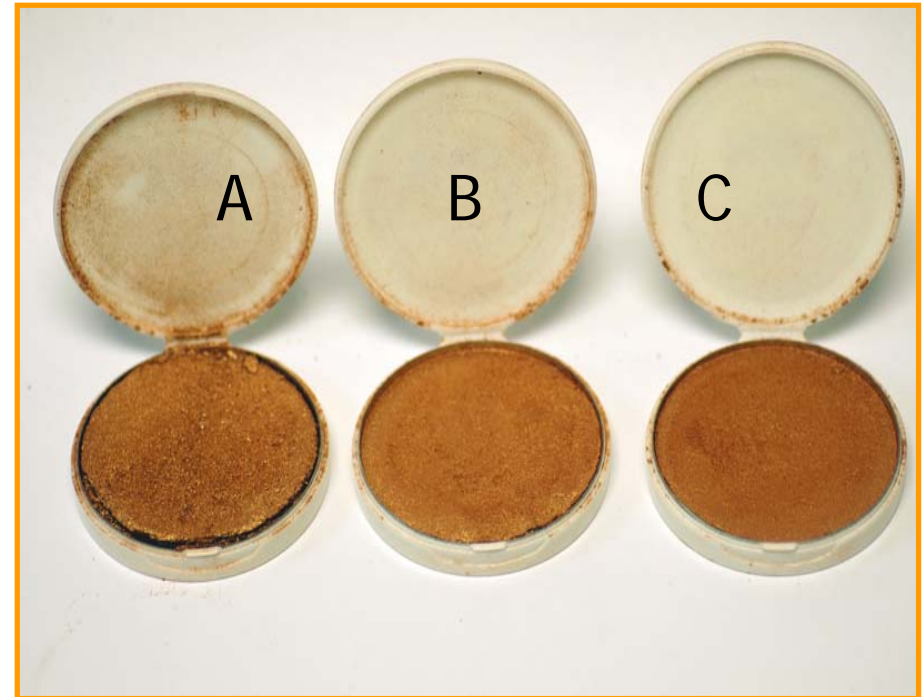
## Properties:

- Excellent hydrophobicity. Stable at pH = 3. No hydrogen potential
- More compatible with ester and oil
- Compatible with binders. Good compressibility
- Nice spreadability, creamy, wet feeling
  
- Used in powder, emulsion, hot pours. Good for cream-to-powder formulas

# Advantages of Alkyl Silane Treated Pearls

Frosted Eyeshadow, 45% KTZ Pearls

Ingredients	A	B	C
Talc N/MM3	-	14.38	14.38
Talc (base)	14.38	-	-
Zinc Myristate	20	20	20
Sunjin PMMA-S	5	5	5
Binder #5	12	12	12
E7015 Red-11S2	3.1	3.1	3.1
E7053 Black	0.52	0.52	0.52
KTZ Bronze-11S2	-	-	45
KTZ Bronze	45	45	-



Binder

<i>Lexol PG-865</i>	33.3
<i>SS4267</i>	10.0
<i>SF96-350</i>	23.3
<i>SF96-20</i>	33.3

# *Dispersibility*

- Most silicone polyether ( DC 5225C, SF1528, Abil<sup>®</sup> WE09) can work as a good dispersant for Alkyl Silane treated pigments.
- Hybridization of creams with powders become practical with Silane treated pigments. Creams transition completely into powders upon application with high concentrations of TCS pigments in a base of octyl myristate and compatible ingredients.
- Alkyl Silane treatments result in a low viscosity product due to the excellent wetting of these pigments. This permits a higher loading of pigments leading to new ideas for products.

# *Common Alkyl Silane Treated Pigments*

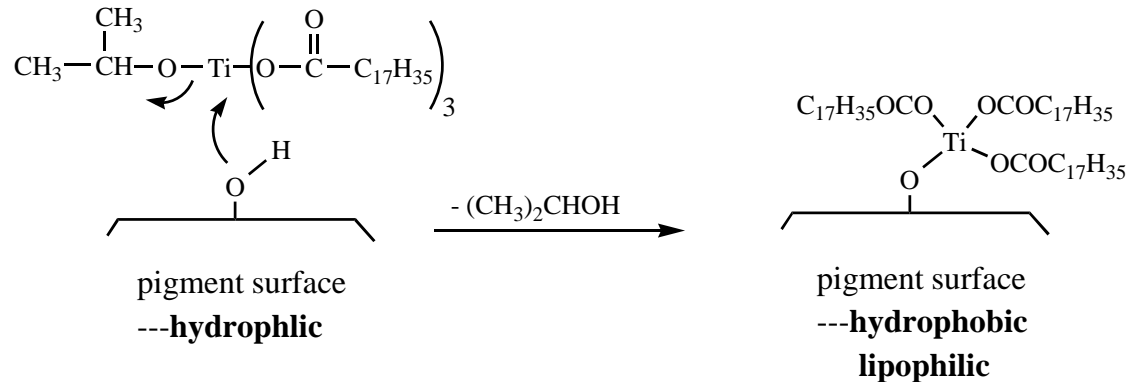
<b>Substrate</b>	<b>Product name</b>
<b>TiO<sub>2</sub></b>	<b>BTD-11S2</b>
<b>Red Iron oxide</b>	<b>BGRO-11S2</b>
<b>Yellow Iron oxide</b>	<b>BGYO-11S2</b>
<b>Black Iron oxide</b>	<b>BGBO-11S2</b>
<b>Mica</b>	<b>GMS-11S2</b>
<b>Talc</b>	<b>Talc U-11S2</b>
<b>Ultramarines</b>	<b>BUB-11S2</b>
<b>UF ZnO</b>	<b>ZNO XZ-11S3</b>
<b>UF TiO<sub>2</sub></b>	<b>SIV-TTS7</b>

## *Example of Finished Products*

Brand	Products
Clinique	Gentle Light Makeup
Max Factor	Face Finity
Estee Lauder	So Ingenious Multi-Dimension Makeup
Estee Lauder	So Ingenious Multi-Dimension Makeup
Prescriptives	Magic Phosphorescent Soft Powder
Prescriptives	Powderful Pressed Powder
Prescriptives	Multi Custom Blend
So Ingenious	Multi-Dimension Loose Powder
Jane	Iced Shadow (Loose Powder)

# Organo Titanate (ITT)

## Isopropyl Titanium Triisostearate



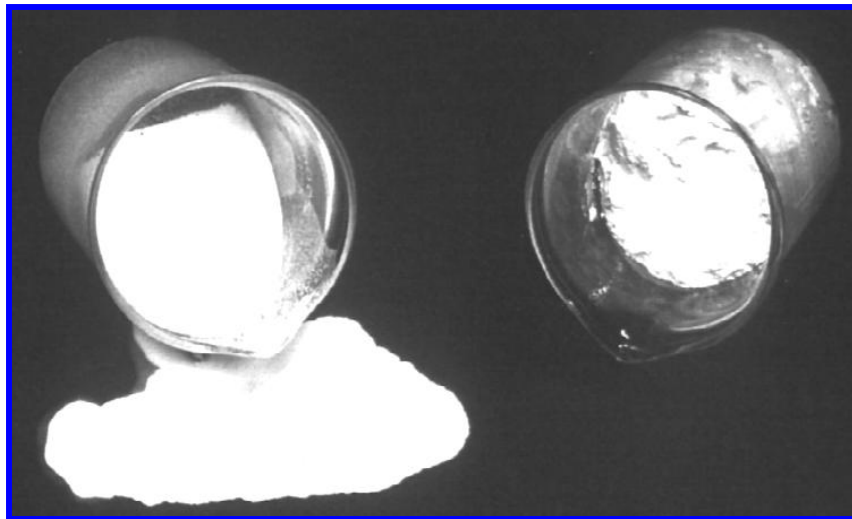
### Properties:

US Pat 4,877,604, ML Schlossman

- Lipophilic and easy to disperse .
- Have excellent affinity to the skin
  
- Not stable to acid
- Hydrophobicity is not as good as silicones

# Comparison of Dispersibility

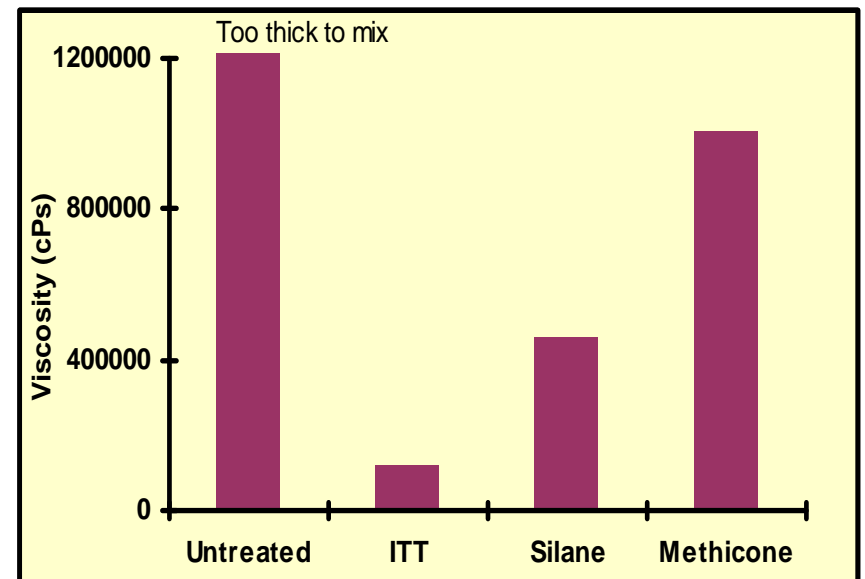
40% Pigment in Mineral oil



ITT treated

Untreated

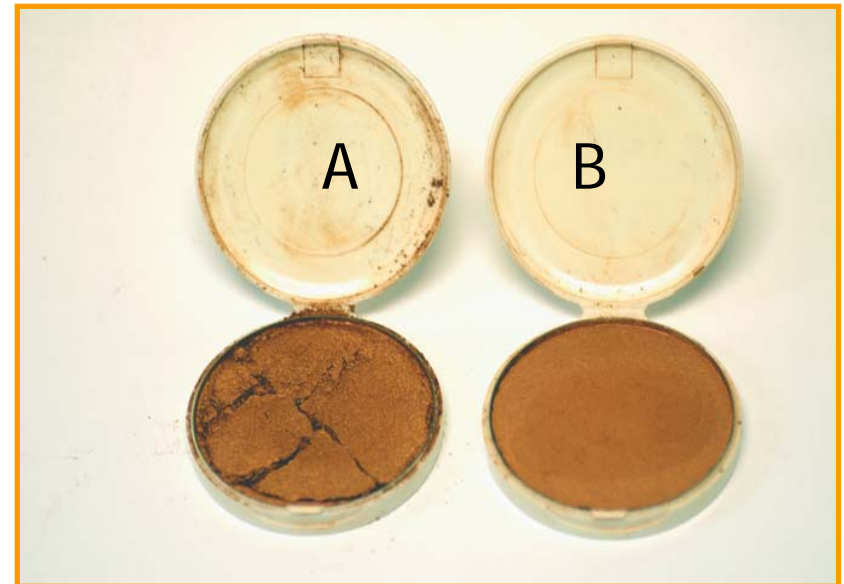
80% Titanium Dioxide  
Octyldodecyl Neopentanoate



# Advantages of ITT -- Treated Pearls

Frosted Eye Shadow, 45%  
KTZ Pearls

Ingredients	A	B
Talc N/MM3	19.38	-
Talc Micro ACE P-2	-	19.38
Zinc Stearate	18	18
SP500	5	5
Binder 4	9	9
E7015 Red-11S2	3.1	3.1
E7053 Black	0.52	0.52
KTZ Copper-I2	45	-
KTZ Copper	-	45



## Binder #4

<i>Lexol PG-865</i>	92.5
<i>Koboguard 5400 CCT</i>	7.5

# *Major Benefits of ITT Treatment*

1. ITT treatment improve greatly the dispersability if treated pigment. It allows high loading of pigments and fillers. Therefore, cream-to - powder formulation can be made to give powdery skin feel
2. ITT treatment greatly improve the compressibility. It is very useful for reduce breakage of pressed powder.
3. ITT treatment has good skin affinity because of fatty group.
4. ITT treated pigments have been used in a wide range of formulations for both premium and mass markets.

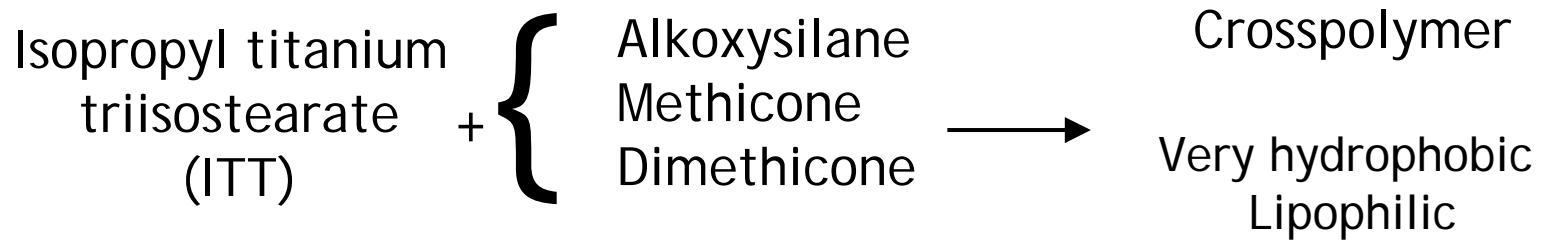
# *Example of Finished Products*

<b>Brand</b>	<b>Product</b>
Maybelline	Maybelline Super Stay Silky Foundation (US and EU)
CoverGirl	Outlast All Day Liquid Makeup
Avon	My Miracle Lipcolor
Farmeco	Covermark Compact Powder
Estee Lauder	Amber Bronze "Air Bronzer" Loss powderd
Maybelline	Dream Matte Mousse Eyeshadow
LO'REAL	Translucide Naturally Luminous Powder with Vitamin C

# Common ITT Treated Pigments

Substrate	Product name
TiO <sub>2</sub>	BTD-I2
Red Iron oxide	BRO-I2
Yellow Iron oxide	BYO-I2
Black Iron oxide	BBO-I2
Mica	GMS-I2
Talc	Talc N-I2
Ultramarines	BUB-I2
Starch	ASO-I2
Red 7 lake	RED 7CA K-I2
Red 6 lake	RED 6BA C-I2
Yellow 5 lake	RED 6BA C-I2
Blue 1 lake	BLUE 1AL-I2

# Crosspolymer Treatment

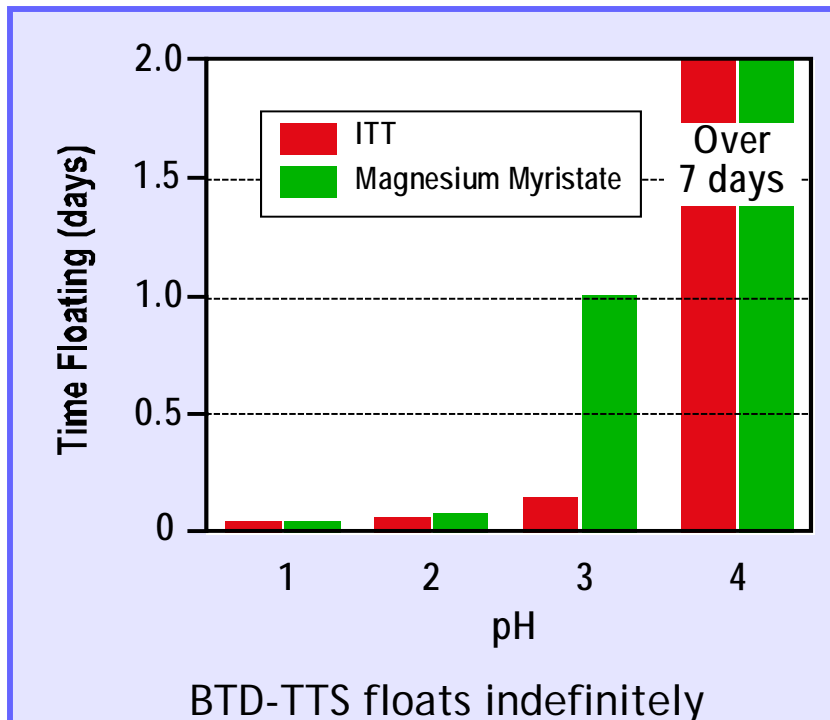


\* WO2005099651

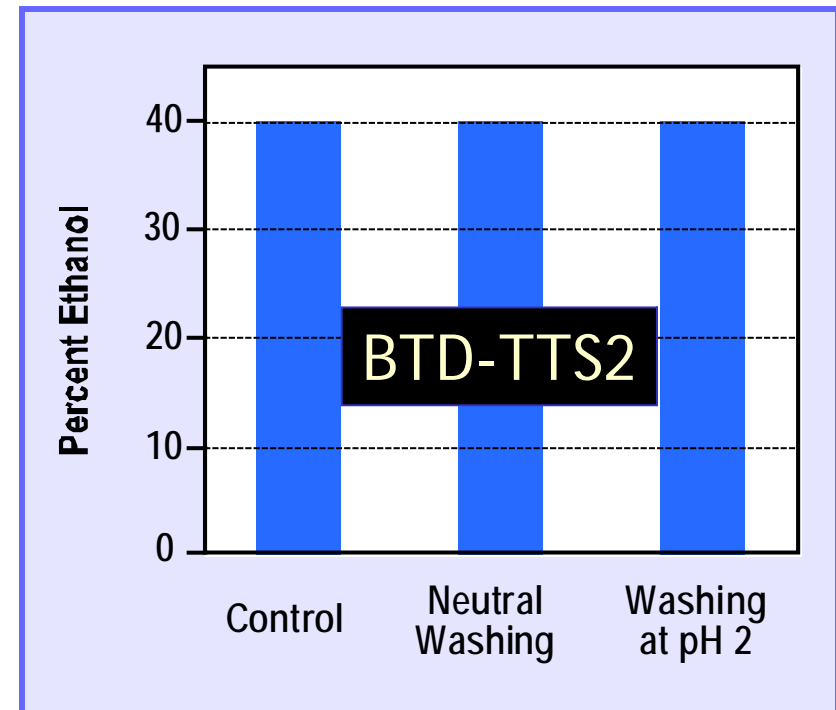
Code	Coating	INCI
TTS	ITT + Silane	Isopropyl Titanium Triisostearate/ Triethoxycaprylylsilane Crosspolymer
TTM	ITT + Methicone	Isopropyl Titanium Triisostearate/ Methicone Crosspolymer
TTB	ITT + Branched dimethicone	Isopropyl Titanium Triisostearate/ Triethoxysilylethyl Polydimethylsiloxyethyl Dimethicone Crosspolymer

# Stability of TTS Treatment Toward Acid

## Floating Test



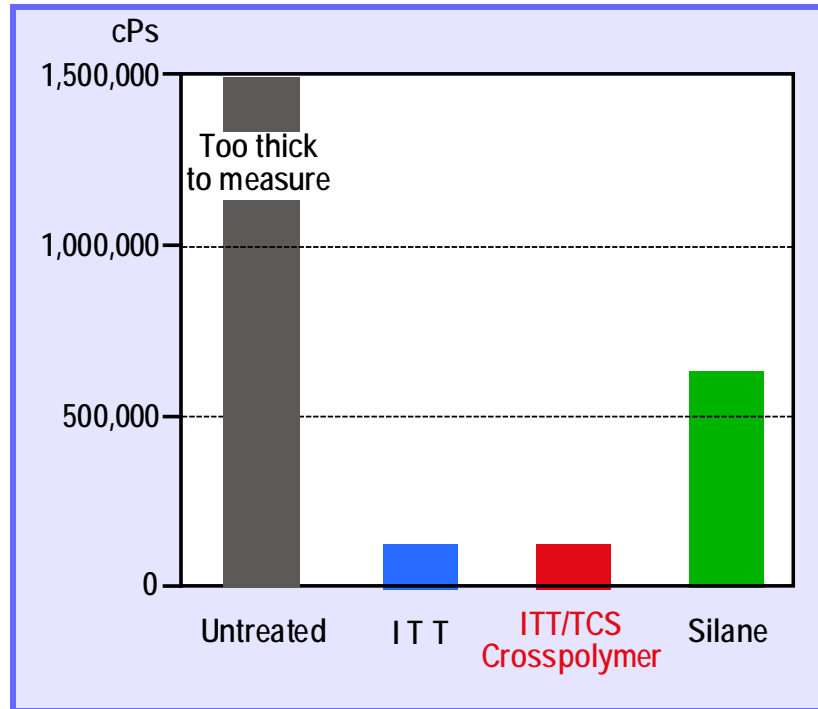
## Acid Washing Test



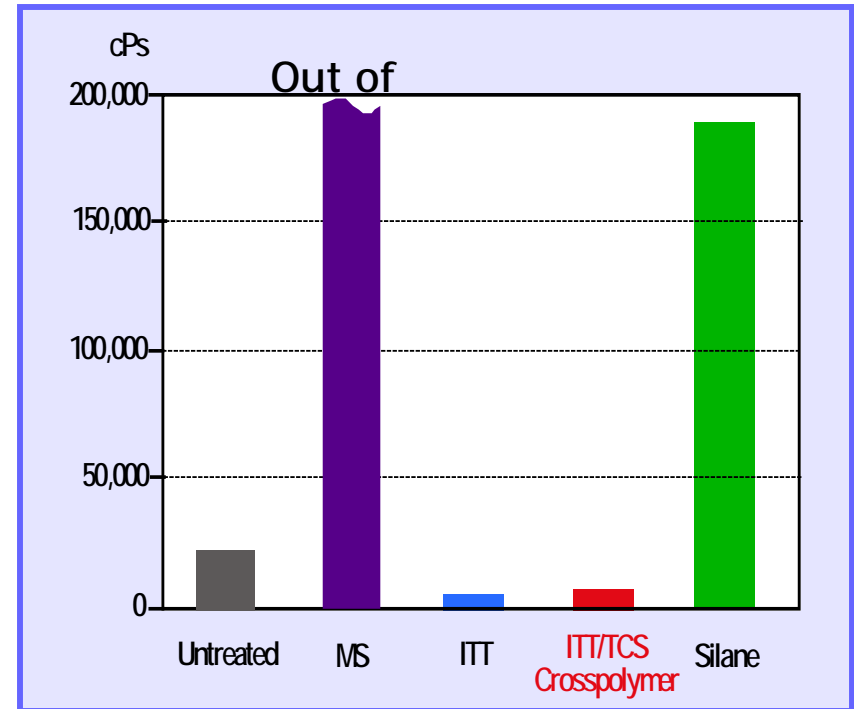
TTS treatment is stable at low pH

# Effect of TTS Treatment --Dispersibility

## 75% Iron Oxide in Mineral Oil



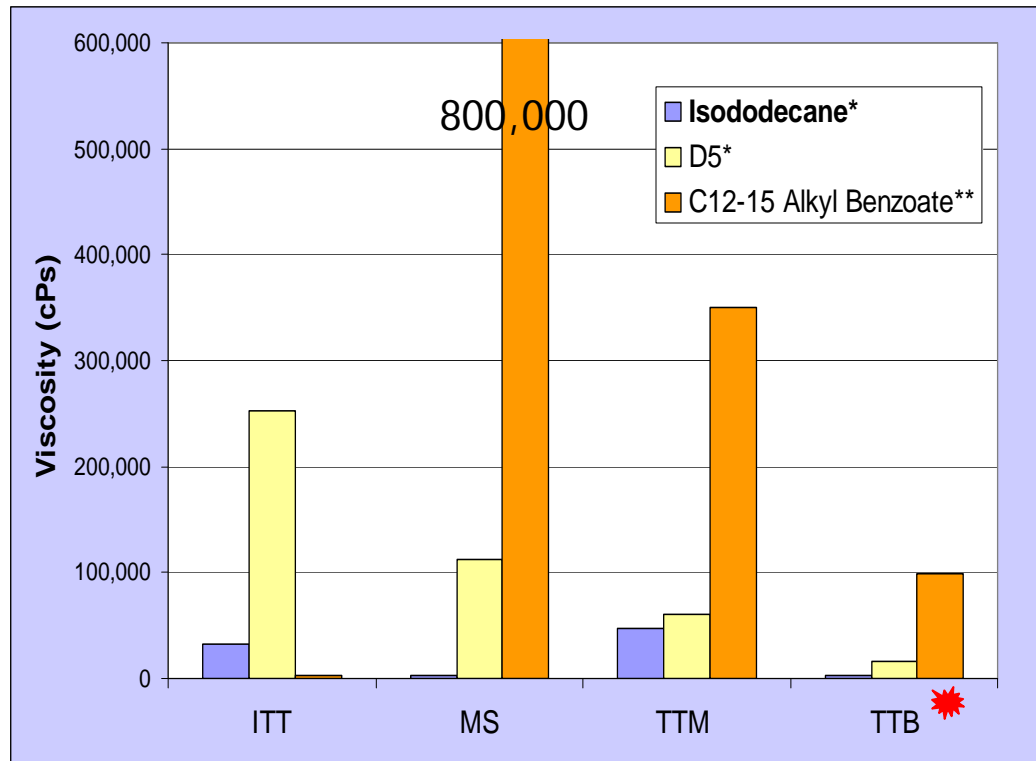
## 75% TiO<sub>2</sub> in C12-15 alkyl Benzoate



\* Dispersant: 1.5 % of polyhydroxystearic acid

# TTB Treatment - ITT/Branched Dimethicone

## Viscosity of 75% Treated Anatase TiO<sub>2</sub> Dispersions



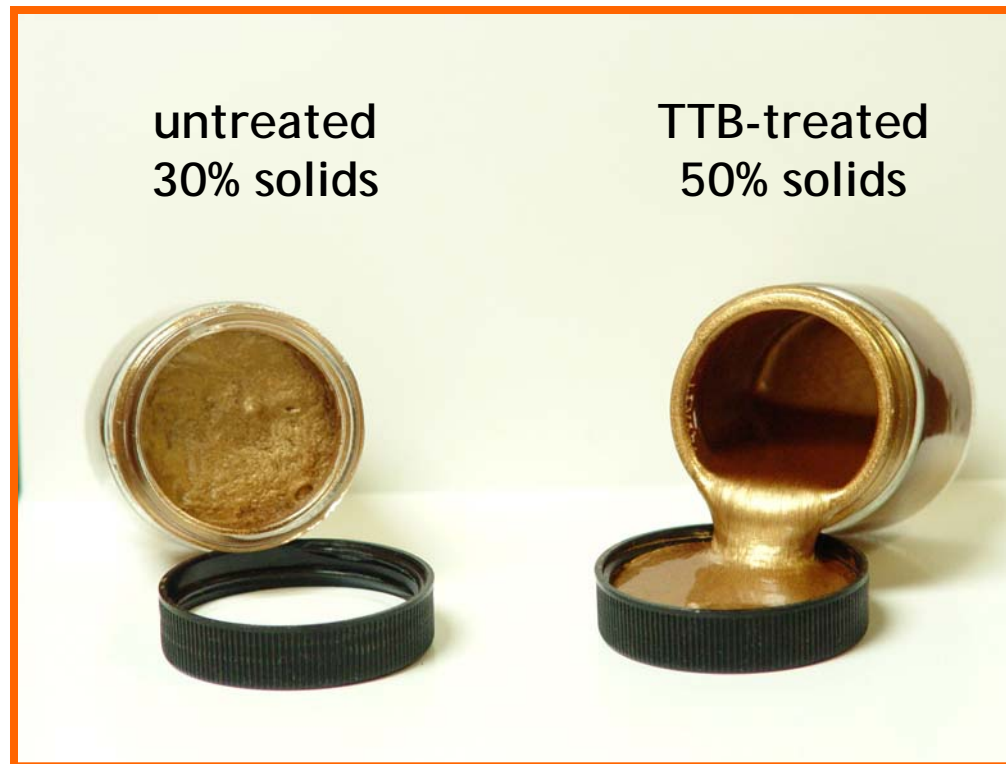
\* w/ 2.5% of PEG/PPG-20/15 dimethicone

\*\* w/ 1.5% of polyhydroxystearic acid

\*TTB treatment - superdispersible in all type of media

# *TTB Treatment - Dispersibility*

## Bronze Pearls in Cyclopentasiloxane



- Treated Mica-Based Pearls wet easier.
- Surface treatment decreases oil absorption, resulting in a more fluid dispersion.

# Pearl in Lipstick Formula

Ingredients	Treated	Untreated
Polyethylene 400PL	5.25	5.25
Performacol	11.0	11.0
Cetyl Lactate	6.0	6.0
Marix SF	5.0	5.0
Hexadecanol	41.9	41.9
Peforma V825	8.0	8.0
Nexbase 2006	8.0	8.0
Triglycerin	4.85	4.85
SW30R7C*	1.5	1.5
SW60ER**	0.5	0.5
KTZ Classic White-TTB2	8.0	-
KTZ Classic White	-	8.0

\* *D&C Red#7 dispersed in Synthetic Wax*

\*\* *Iron Oxide Red dispersed in Synthetic Wax*

# *Using Pearls in Lipsticks*



Using untreated Pearls

Using treated Pearls

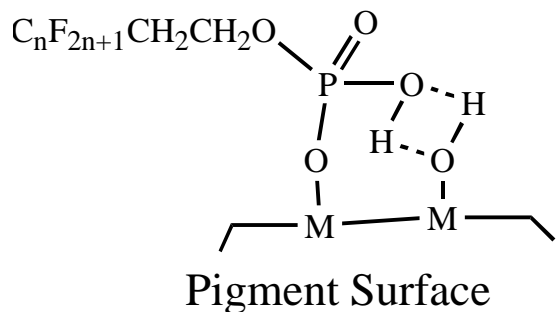
# *Major Benefits of Crosspolymer Treatment*

- Hydrophobic and lipophilic
- Render pigments and powders superdispersible. Among them, TTB treatment exhibits the highest degree of dispersibility
- Compatible with esters/ hydrocarbons as well as with silicones
- Stable over a wide range of pHs
- Improve skin affinity and wear

# Common Cross Polymer Treated Pigments

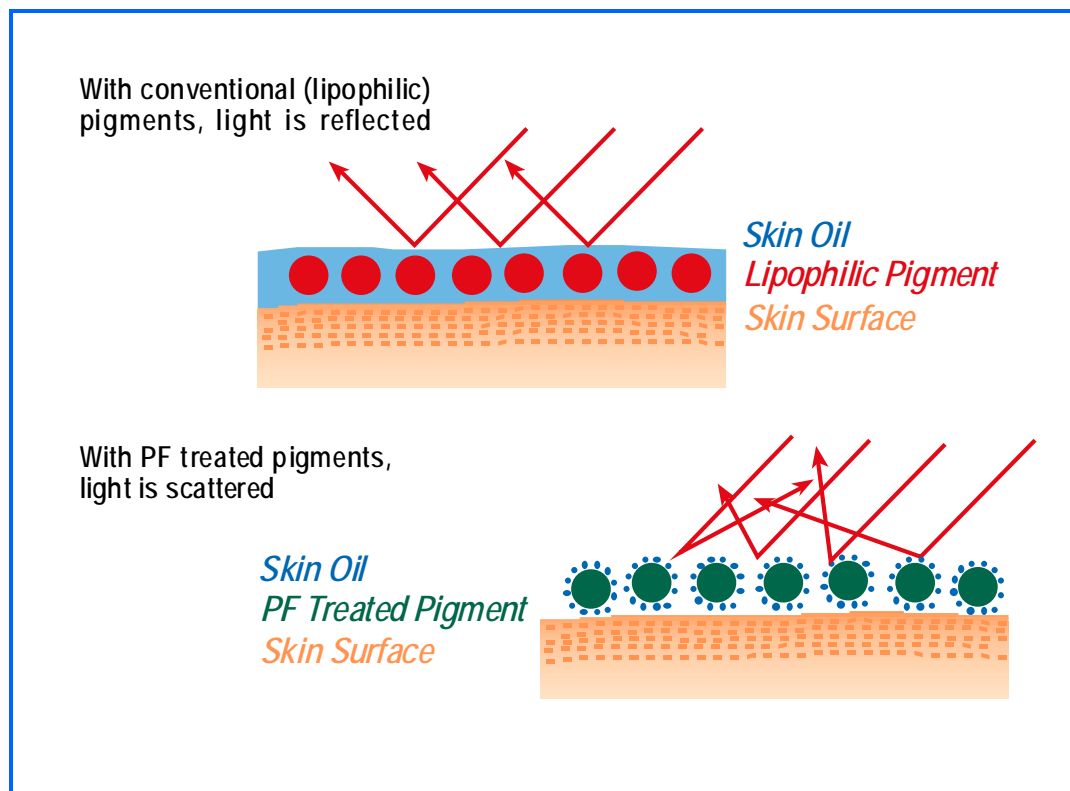
Substrate	TTB treated	TTS Treated
TiO <sub>2</sub>	BTD-TTB2	BTD-TTS2
Red Iron oxide	BGRO-TTB2	BGRO-TTS2
Yellow Iron oxide	BGBO-TTB2	BGBO-TTS2
Black Iron oxide	BGYO-TTB2	BGYO-TTS2
Mica	GMS-TTB4	--
Talc	TALC N-TTB2	TALC N-TTS2
Ultramarines	BEUB-TTB2	BEUB-TTS2
Blue 1 lake	BLUE 1AL S-TTB2	BLUE 1AL S-TTS2
Red 7 lake	RED 6BA S-TTB2	RED 6BA C-TTS3
Red 6 lake	RED 7CA C-TTB2	RED 7CA K-TTS2
Yellow 5 lake	YELLOW 5AL S-TTB2	YELLOW 5AL -TTS2
Yellow 6 lake	YELLOW 6AL C-TTB2	--
Pearl pigments	KTZ xxx-TTB2	KTZ xxx-TTS2

# C9-15 Perfluoroalcohol Phosphates (PFX)



## Properties:

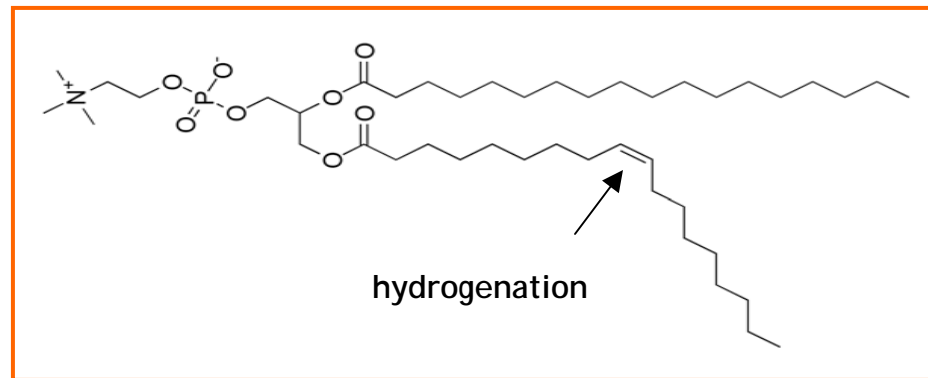
- Hydrophobic
- Lipophobic
- Good for long wear
- Hard to wet or process



E.I. Du Pont, US 3,632,774

# Natural Surface Treatment

## (Hydrogenated) Lecithin



A natural phospholipid with anti-oxidant, moisturizing and emollient properties

### Properties of treated pigments:

- Fairly hydrophobic yet moisturizing.
- Creamy feel and excellent affinity to the skin
- Very good for powders and mineral makeups
- Also can be used in emulsions and hot pours

# *Natural Surface Treatment*

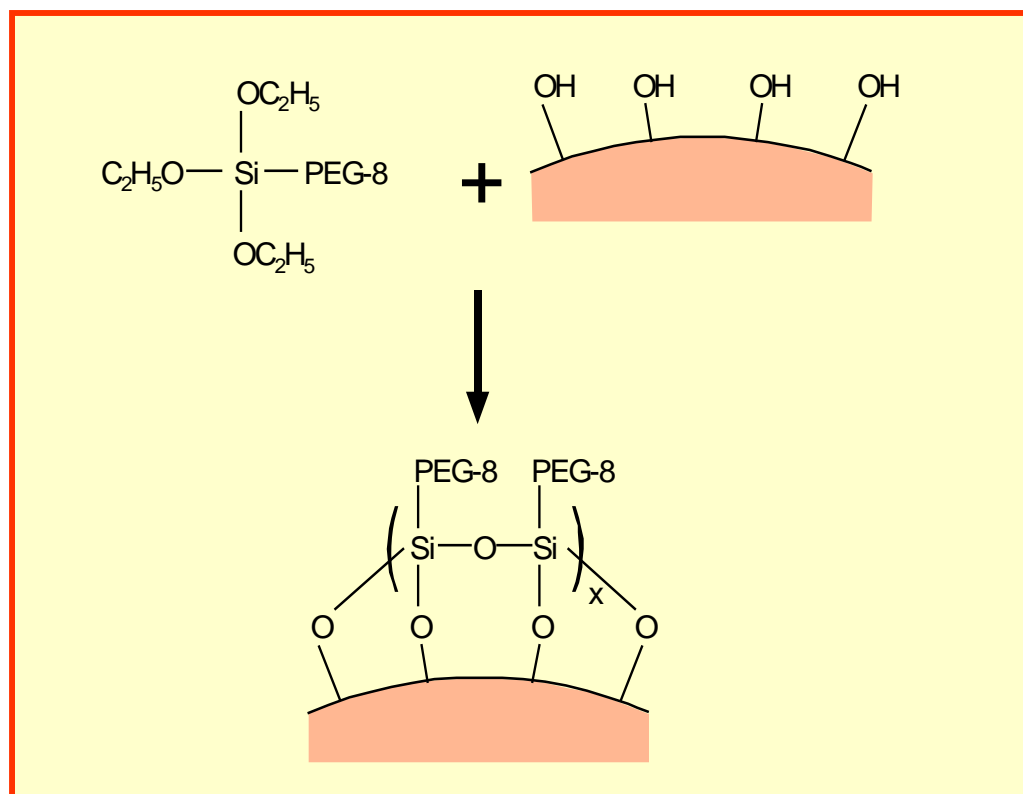
## Jojoba Ester

- Interesterification product of jojoba oil
- Chemical similar to the human skin sebum
- High oxidative stability.

### Properties of treated pigments:

- Hydrophobic
- Coating is stable and does not turn rancid upon heating
- Creamy feel and good affinity to the skin
- Good pressability
  
- Very good for powders
- Good for natural formulation
- Patent Pending

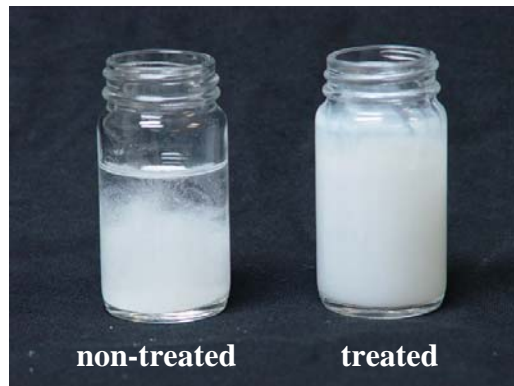
# Hydrophilic treatment (-SW)



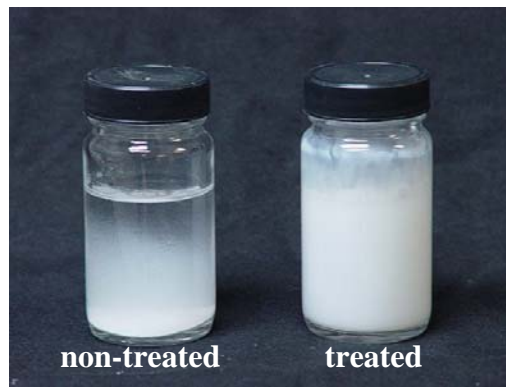
**INCI: PEG-8 Methyl Ether Triethoxysilane**

# *Effect of Treatment on Dispersibility*

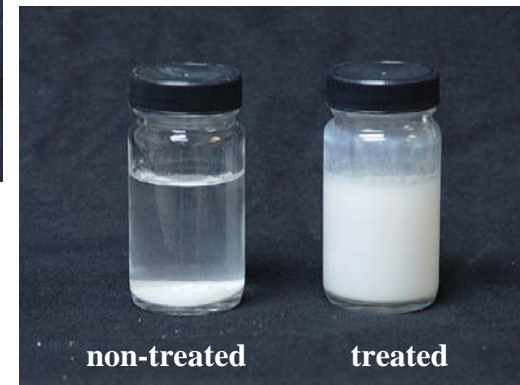
**Immediately after mixing**



**After 30 seconds**



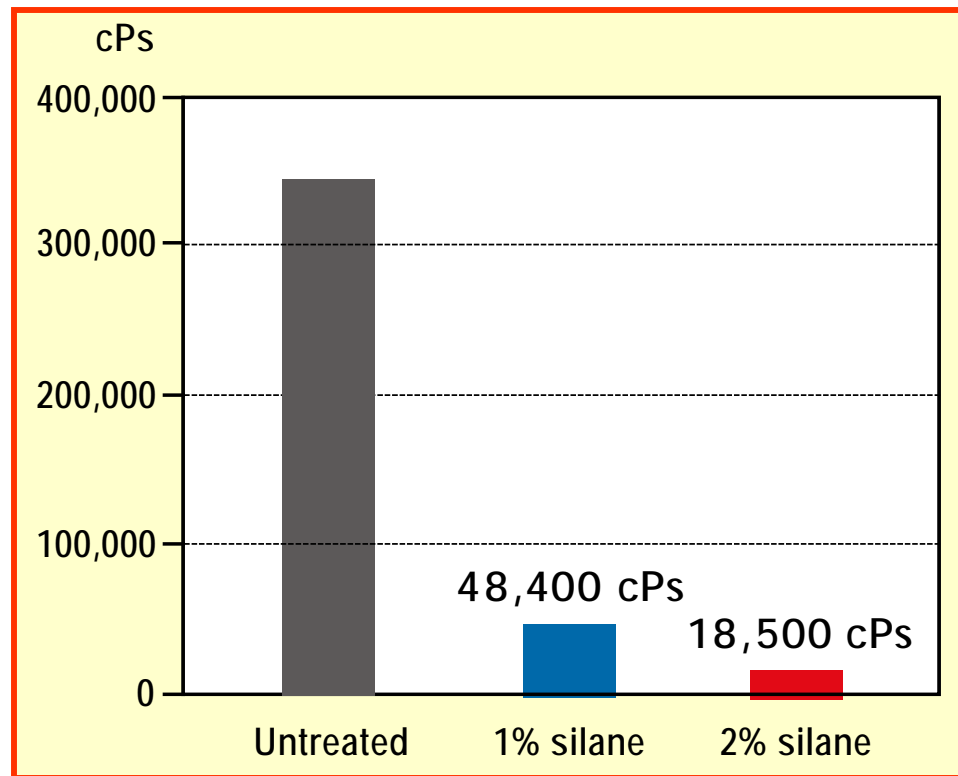
**After 10 minutes**



Add 2 g of TiO<sub>2</sub> CR-837 to 50 mL of H<sub>2</sub>O

# Effect of Treatment on Dispersibility

## Viscosity of 65% Pigmentary TiO<sub>2</sub> in Water





Thank you!