

# Optical Effects of Particles

SPECIALTY FLUIDS - PERSONAL CARE



An aging global population and the desire of consumers to maintain a youthful appearance have created a growing anti-aging market segment in the health and beauty industries. Skincare product manufacturers have responded with a growing number of treatments aimed at reviving or preserving skin health. While many of the products have proven successful in revitalizing skin, the results are not instantaneous and have only been achieved by consistent and ongoing application. Human nature demands results be immediate and visible, presenting a significant challenge to the formulator. Sensory enhancer particles from Momentive Performance Materials enable the formulation designer to simulate instantly the appearance of flawless, bright, luminescent skin, encouraging the consumer to reapply and eventually realize skin vitality.

## Key Features and Typical Benefits

- Imperfections are minimized – soft focus effect
- Skin's appearance is improved – glow and radiance
- Natural appearance with sheer radiance
- Natural appearance with sparkle
- Even distribution of light
- Instant brightening
- Coverage

## Potential Applications

- Color cosmetics
- Anti-aging
- Daily wear skin creams and lotions
- Serums
- Anti-acne
- Moisturizers
- Cleansers
- Skin imperfection correctors
- Sunscreens
- After tanning products

### Soft Focus Effect with Tospearl\* Microspheres

Optical Property	Skin Appearance Benefit	Tospearl Microspheres
High Diffused Transmission	Minimize Skin Imperfection Natural Appearance	More than 50% diffused transmission with Tospearl 150KA Microspheres

### Optical Effects with Softouch\* Boron Nitride Platelets

Optical Property	Skin Appearance Benefit	Momentive Softouch Boron Nitride Platelets
High Total Transmission	Natural Appearance	Momentive Softouch CCS102J – Radiance, glow Momentive Softouch CCS402 – Sparkle/shimmer
High Diffused Transmission	Minimize Skin Imperfection	Momentive Softouch CC6097 – Soft focus
High Scattered Reflection	Even Light Distribution	Momentive Softouch CC6097 & Velvesil* Mul-T Gel – Matte finish

Typical Physical Properties				
	INCI	Refractive Index	Particle Size (microns)	Particle Shape
Tospearl Microspheres	Polymethylsilsesquioxane	1.42	2 - 11	Spherical
Momentive Softouch Boron Nitride Platelets	Boron Nitride	2.10	5 - 50	Platelets

Typical properties are average data and are not to be used as or to develop specifications.

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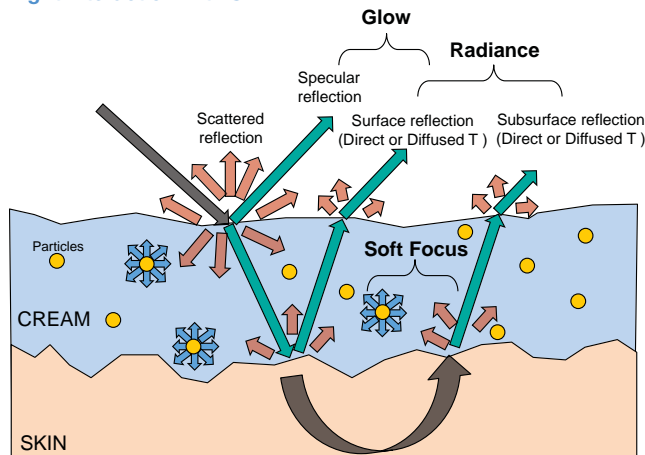
# Performance Data: Optical Effects of Particles

## Overview

Momentive Performance Materials offers cosmetic particles with a wide range of morphology and surface properties used to provide a variety of optical effects in cosmetic formulations.

Light interacts with skin by either being reflected or transmitted through the cosmetic film. Both the transmitted and reflected light has two components; direct and diffused. Introducing light scattering particles into cosmetic preparations affects these properties and impacts skin appearance by hiding skin imperfections and improving glow and radiance of skin.

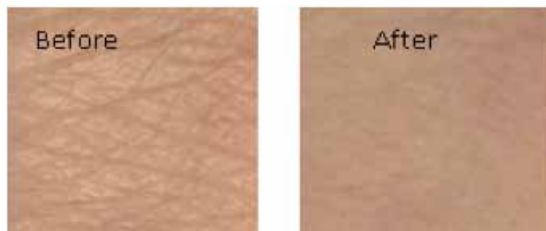
## Light Interaction with Skin



## Hiding Skin Imperfections by “Soft Focus Effect”

Skin imperfections are perceived due to the contrast created either by the light trapped in wrinkles or absorbed by skin pigments. Reducing the contrast between wrinkles and imperfections and the skin will minimize the visual appearance of these imperfections. This phenomenon is commonly referred to as “Soft Focus effect”.

### Hiding the Imperfections due to wrinkles



### Hiding the Imperfections due to hyperpigmentation



Product formulations are included as illustrative examples only. Momentive makes no representation or warranty of any kind with respect to any such formulations, including, without limitation, concerning the efficacy or safety of any product manufactured using such formulations.

Note: Test results. Actual results may vary.

## Soft Focus: Reduce the contrast by blurring the imperfection

Two different imperfections, wrinkles and pigmentation marks have to be treated differently. Wrinkles affect the distribution of particles as the particles tend to segregate in them. Such particle segregation is not observed in case of pigmentation marks.

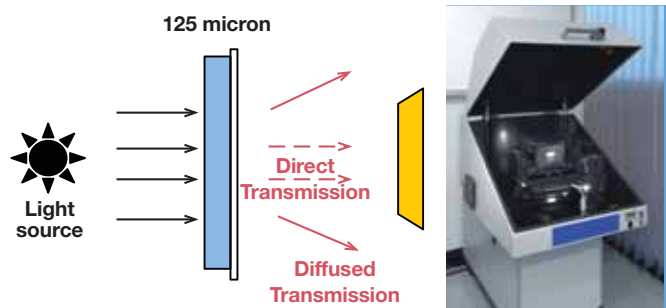
Other factors affecting the optical effects of cosmetic formulations are the thickness of the applied formulation, particle size distribution within it, and its texture. Formulators also need to take into consideration the properties of particles being used such as the refractive index difference between the medium and the particle, as well as the particles' size, shape, morphology, and concentration.

GOAL: to maximize diffused transmission and scattered reflection for better soft focus effect.

Optical Property	Skin Appearance Benefit
High Total Transmission	Natural Appearance
High Diffused Transmission	Minimize Skin Imperfection
High Scattered Reflection	Even Light Distribution

## Measuring Optical Properties of Films

Optical properties of cosmetic films are measured using ColorEye 7000 A and goniospectrophotometer.



After measuring the total and direct transmission of dried films, diffused transmission is calculated as

$$\text{Diffused transmission} = \text{Total transmission} - \text{Direct transmission}$$

## Model Formulation

Model formulation used for demonstrating optical properties of Tospearl\* and Boron nitride particles contains 1% of particles.

Ingredient	% w/w
Cyclopentasiloxane	79
Dimethicone (500 cst)	10
SilForm* Flex resin	10
Particles	1

After the film is completely dried, it will constitute of approximately 5% of particles in it.

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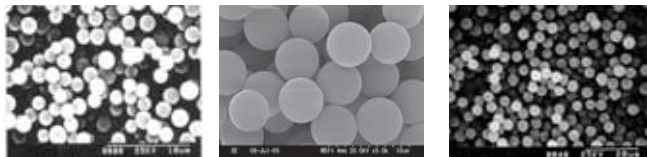
## Performance Data: Optical Effects of Particles

### Silicone Spheres

Momentive Performance Materials offers solid, spherical T-resin particles as dry powders (Tospearl\*) and as oil-in-water emulsion (Silsoft\* E-Pearl PF emulsion).

### Tospearl Microspheres

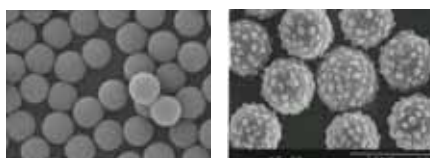
- 100% active
- Variety of particle sizes (2 - 12 micron)
- Refractive index 1.42



Tospearl 120A

Tospearl AQ

Tospearl 145A

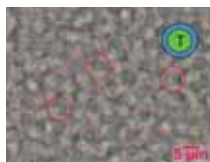


Tospearl 1110A

Tospearl 150KA

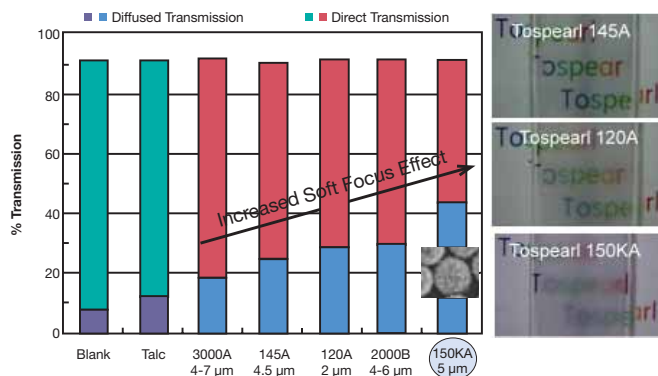
### Silsoft E-Pearl Emulsion

- O/W emulsion with Tospearl
- Easily water dispersible



### Diffused Transmission with Tospearl\* Microspheres

It was demonstrated that a boost in soft focus may be achieved by increasing the surface roughness of the particle as in the case of Tospearl 150KA.



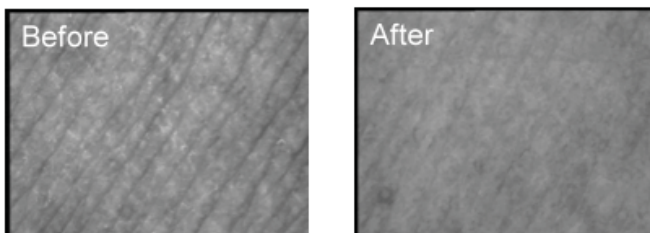
### Key Highlights:

- 90% total transmission
- Less loss in reflection (Less RI difference)
- Increased diffused transmission by surface roughness

Note: Test data. Actual results may vary.

### Line Blurring with Silsoft E-Pearl PF Emulsion

Silsoft E-Pearl PF emulsion, which is a non-ionic emulsion of Tospearl microspheres, also improved the wrinkle hiding effects for aqueous formulations. After applying the Silsoft E-Pearl PF emulsion to arm, wrinkles were practically hidden even at a microscopic level.



The image analysis of similar images of model formulation applied to arm is used to calculate the wrinkle index.

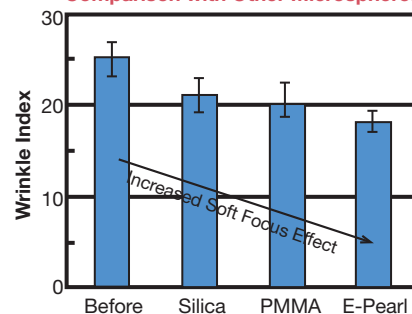
$$\text{Wrinkle Index} = \frac{\sum_{n=1}^N (Z_{max} - Z_n)}{N}$$

Wrinkle index is an easy way to determine contrast of the image. Lower the wrinkle index lower is the contrast and thus better is the wrinkle hiding.

### Model Formulation

Ingredient	% w/w
Sepigel	1
Glycerine	7
Butylene glycol	4
Silsoft E-Pearl Emulsion	5
Water	q.s. 100

### Comparison with Other Microspheres



Product formulations are included as illustrative examples only. Momentive makes no representation or warranty of any kind with respect to any such formulations, including, without limitation, concerning the efficacy or safety of any product manufactured using such formulations.

Silsoft E-Pearl PF emulsion provided better wrinkle hiding for aqueous formulations than silica and PMMA microspheres.

### Summary of Tospearl Microspheres Technology for Soft Focus

Optical Property	Skin Appearance Benefit	Tospearl Microspheres
High Total Transmission	Natural Appearance	90% transmission with 6% Tospearl Microspheres
High Diffused Transmission	Minimize Skin Imperfection	More than 50% diffused transmission with Tospearl 150KA Microspheres
High Scattered Reflection	Even Light Distribution	Low reflection due to RI match with medium

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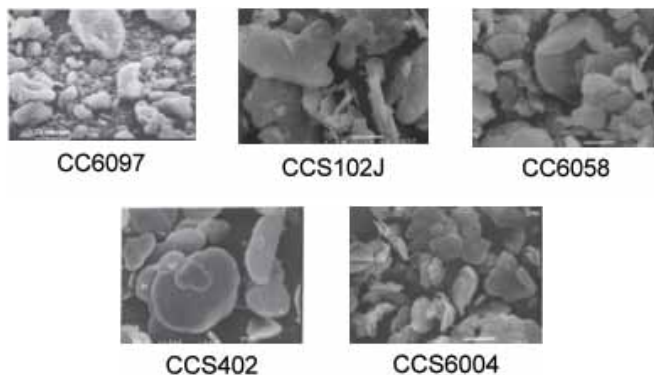
## Performance Data: Optical Effects of Particles

### Boron Nitride Platelets

Momentive Performance Materials offers boron nitride platelets as dry powders (Momentive Softouch\* BN powder) and formulated gels (Velviesil\* Mul-T gel).

### Momentive Softouch Boron Nitride Powder

- Arrays of crystal morphologies (5 – 50 micron)
- More lubricious than talc and nylon beads
- Refractive index = 2.1

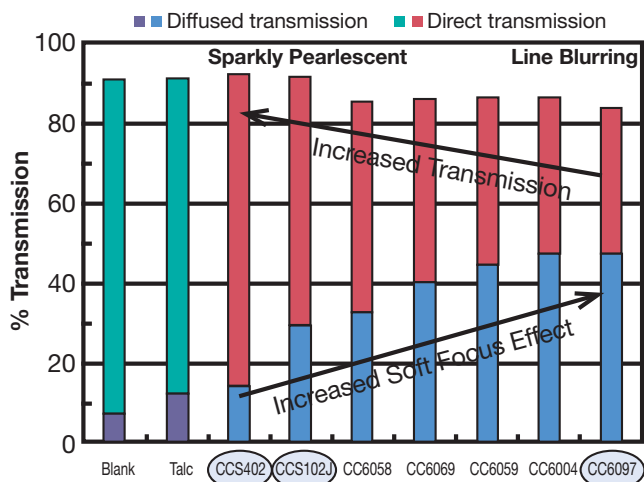


### Velviesil Mul-T gel

- Synergistic blend of Silicone gel and Momentive Softouch Boron Nitride
- Ease of formulating boron nitride

### Diffused Transmission with Momentive Softouch Boron Nitride Powder

It was found that Momentive Softouch CC6097 powder with its small particle size and crystal imperfections was the best for soft focus. Momentive Softouch CCS402 and CCS102J powders preserved the natural appearance of skin due to higher transmission than the other boron nitride powders.



### Key Highlights:

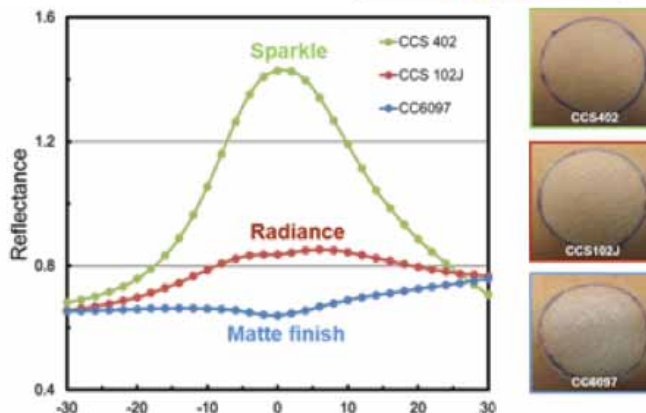
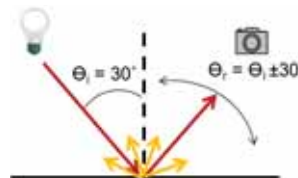
- Total transmission: Crystal structure dependent
- Higher loss in reflection (High RI difference)
- Increased diffused transmission by crystal imperfections

Note: Test data. Actual results may vary.

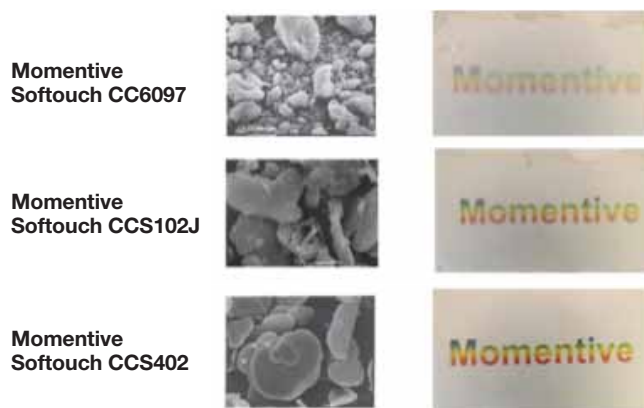
### Reflectance with Momentive Softouch Boron Nitride Powders

#### Model Formulation

Ingredient	% w/w
Silicone gel	96
Momentive Softouch Boron Nitride platelets	4



Because of higher refractive index difference between the medium and the particles, boron nitride platelets reflect light. Reflectance is an essential for improving radiance, glow and shine. Reflectance study of a model formulation is carried out. The following figure shows visual appearance of total and diffused transmittance when the model formulation was applied to transparencies. As seen in images, Momentive Softouch CC6097 powder provided excellent diffused transmission required for soft focus and the Momentive Softouch CCS402 and CCS102J powders maintained high total transmission required for natural skin appearance, radiance and glow.



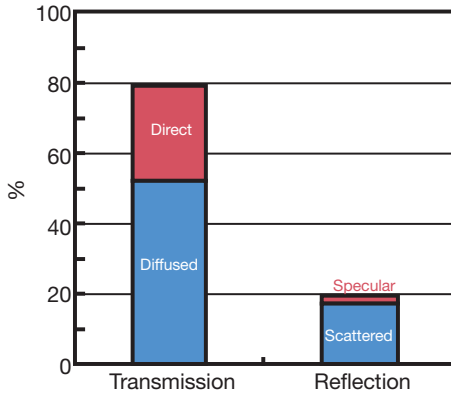
### Radiance and sparkle with Momentive Softouch Boron Nitride Powders

The Momentive Softouch CCS402 powder provided highest reflectance and when applied to skin provided sparkly powder optical effect. Contrary to Momentive Softouch CCS402 powder, the Momentive Softouch CC6097 powder demonstrated scattered reflectance which is necessary for soft focus and uniform coverage. The reflectance properties of Momentive Softouch CCS102J powder were between those of the other two platelets and is evident by application to the skin provided a seamless natural looking glow and radiance.

## Performance Data: Optical Effects of Particles

### Velvesil\* Mul-T gel: Even Light Distribution

Velvesil Mul-T gel, which is a synergistic blend of silicone gel and Momentive Softouch\* Boron Nitride platelets, was found to provide an even distribution of light so that the skin imperfections due to pigmentation were significantly diminished by the soft focus effect. Following figure illustrates the transmission and reflectance from a 125 micron thick film of the Velvesil Mul-T gel.



### Summary of Momentive Softouch Boron Nitride platelets for Soft Focus

Optical Property	Skin Appearance Benefit	Momentive Softouch Boron Nitride Powders
High Total Transmission	Natural Appearance	Momentive Softouch CCS102J - Radiance, glow Momentive Softouch CCS402 - Sparkle/shimmer
High Diffused Transmission	Minimize Skin Imperfection	Momentive Softouch CC6097 - Soft focus
High Scattered Reflection	Even Light Distribution	Momentive Softouch CC6097 & Velvesil Mul-T Gel - Matte finish

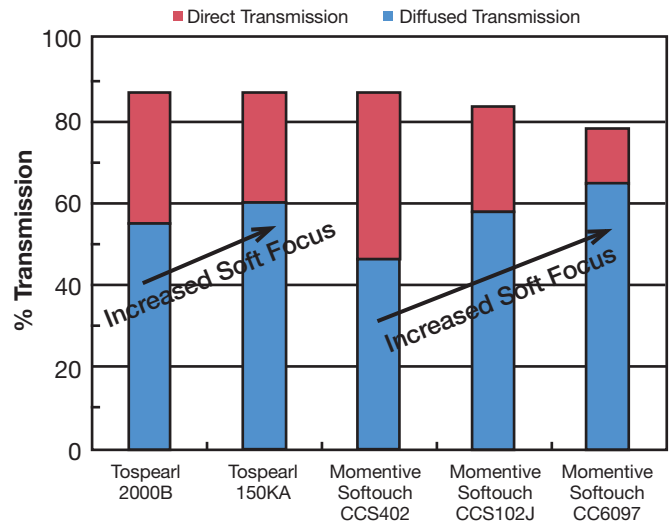
### Moisturizing Cream: Transmittance

For a transmittance study, a basic moisturizer cream formulation was employed to examine the optical properties of a cosmetic film containing Tospearl\* microspheres and Momentive Softouch Boron Nitride platelets.

Part	INCI Name	% w/w
A	Deionized Water	83.07
	Disodium EDTA	0.05
	Carbomer	0.2
	Preservative	q.s.
B	Momentive Softouch BN	1.00
	Butylene Glycol	2.5
C	Cetyl Ethylhexanolate	5.00
	Sorbitan Stearate	1.5
	Polysorbate 60	1.0
	Cetearyl alcohol (and) Ceteareth-20	1.5
	Cyclopentasiloxane (and) Dimethicone Phenoxylethanol (and) Preservative	1.5
D	Deionized Water	1.00
	Aminomethyl Propanol	0.18
E	Polyacrylate-13 (and) Polyisobutene (and) Polysorbate-20	0.5

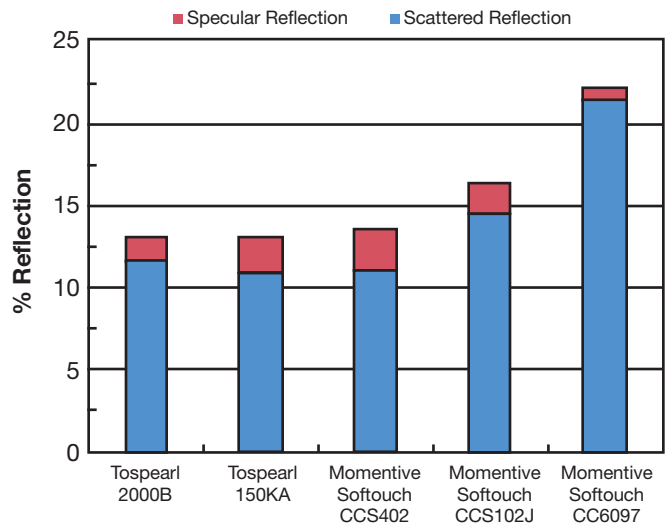
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The plot below demonstrates that the Tospearl 150KA and Momentive Softouch CC6097 provided optimal soft focus. Also, the Momentive Softouch CCS402 and CCS102J maintained higher transmission which is necessary for natural appearance of skin.



### Moisturizing Cream: Reflectance

Using the same moisturizing cream to measure reflectance, it was observed that Momentive Softouch CC6097 powder had the most even distribution of light (high scattered reflection) while Momentive Softouch CCS402 powder had the highest specular reflection, which correlates to a sparkly effect on the skin. Momentive Softouch CCS102J powder was again between the two other platelets studied and whose optical effects could be described as bright, radiant, and pearlescent. Once again, more scattered reflection due to surface roughness was observed in case of Tospearl 150KA microspheres.



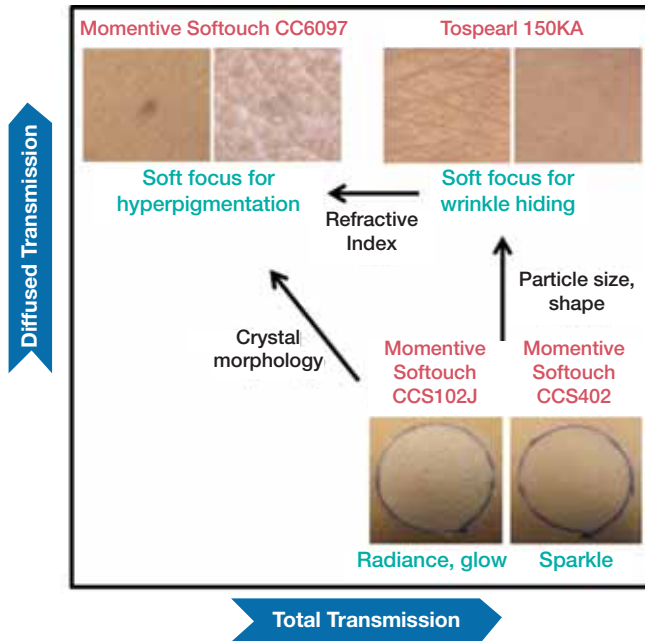
Note: Test data. Actual results may vary.

## Performance Data: Optical Effects of Particles

### Summary of Tospearl\* and Momentive Softouch\* Product Optical Effects Options

Tospearl microspheres and Momentive Softouch Boron Nitride platelets can offer flexibility in achieving a range of optical properties including the masking of skin defects such as hyperpigmentation and fine lines and wrinkles. They can also be a very useful tool for the formulator to achieve optical effects including instant radiance, luminosity, and a means to counteract dull lifeless skin.

### Positioning of Momentive Particles



Note: Test results. Actual results may vary.

## Performance Data: Optical Effects of Particles

### Patent Status

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Customers should review the latest Material Safety Data Sheet (MSDS) and label for product safety information, safe handling instructions, personal protective equipment if necessary, emergency service contact information, and any special storage conditions required for safety. Momentive Performance Materials (MPM) maintains an around-the-clock emergency service for its products. MSDS are available at [www.momentive.com](http://www.momentive.com) or, upon request, from any MPM representative. For product storage and handling procedures to maintain the product quality within our stated specifications, please review Certificates of Analysis, which are available in the Order Center. Use of other materials in conjunction with MPM products (for example, primers) may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials.

### Limitations

Customers must evaluate Momentive Performance Materials products and make their own determination as to fitness of use in their particular applications.

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