MIRAGE Borosilicate Pigments – Highlights for Decorative Cosmetics

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ABSTRACT

MIRAGE borosilicate pigments represent a new variety in the well-known class of pearlescent pigments. Consisting of flake-shaped transparent particles coated with high refractive metal oxides, at first glance they show the same structural features as traditional mica-based interference pigments.
However, in contrast to natural mica flakes, innovative artificial borosilicate substrates with tailor-made properties achieve optimum interference effects in combination with outstanding transparency unrivalled by any mica-based pearlescent pigments. Thanks to the achromatic and highly transparent substrate and an advanced metal oxide coating technology, MIRAGE borosilicate pigments exhibit unique colour purity and extraordinary gloss.
Borosilicate pigments are especially suited for transparent application systems such as lip gloss to showcase their exceptional performance and open up new possibilities for formulators looking to enhance the eye-catching effects achieved in colour cosmetic products. The growth rate of lip products containing borosilicate pigments is significantly above that of any other applications such as nail or eye colour cosmetics using such pigments over the past five years. The outstanding performance of the MIRAGE line of borosilicate pigments offers unparalleled opportunities for achieving superior results.

Borosilicate vs. natural mica flakes

A common feature of all gloss effect pigments is a flake-like structure which enables directional reflection of incoming light and hence, gloss effects. [1]
Borosilicate pigments belong to the group of pearlescent effect pigments which are generally composed of low refractive transparent platelets like mica coated with high refractive metal oxides, *e.g.* titanium dioxide or iron oxides (**Fig. 1**). In the first step, an amorphous and still fragile coating consisting of metal oxide hydrates is deposited on the flakes. In order to increase the stability and to enhance the effect, a thermal treatment follows which results in pearlescent pigments with a high refractive crystalline metal oxide coating layer.
This structure creates interfer-

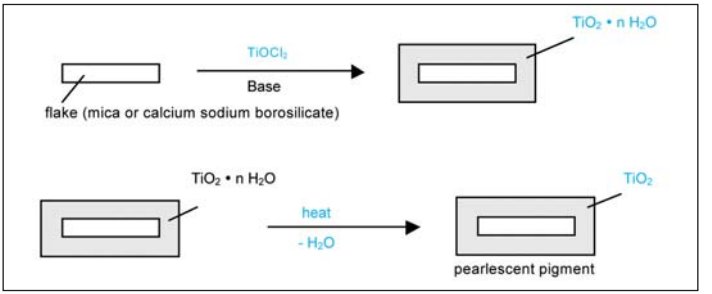

Figure 1: Coating of a transparent substrate with titanium dioxide.

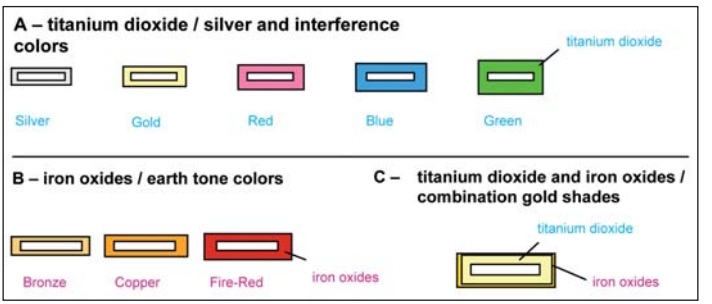

Figure 2: Pearlescent pigments – a kaleidoscope of colours.

ence effects leading to selective reflection of distinct colours thereby creating the typical pearl luster as frequently found in nature. Depending on the thickness of the metal oxide coating, pearlescent pigments mimic a full range of rainbow colours as well as earth tone and golden colour shades (**Fig. 2**).

Since decades, natural mica, an alumosilicate mineral with an intrinsic multi-layer structure, was and still is used as the state-of-the-art substrate for manufacturing traditional pearlescent pigments. This material unavoidably shows some basic deficiencies like variations in the composition due to

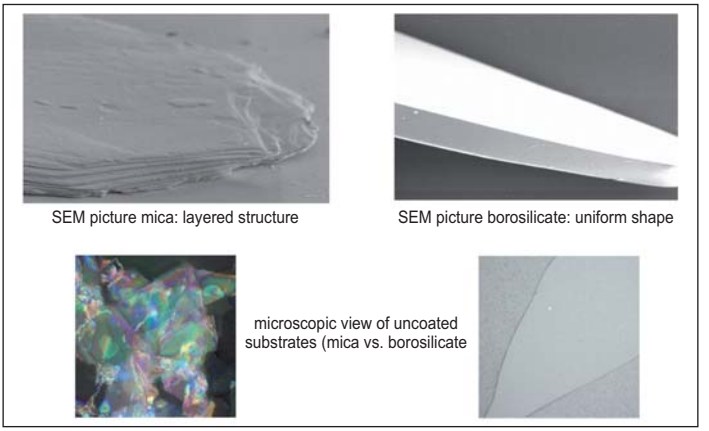

Figure 3: Natural mica vs. borosilicate flakes.

naturally occurring deviations. As mica flakes need to be milled down and further processed to obtain the appropriate particle size fractions for pigment production, irregular shaped micro-scale platelets with many scattering sites (*e.g.* the edges) are created. Moreover, thickness deviations within single particles and also among particles may result as milling causes random breakage and delamination of the flakes. Individual mica flakes show various interference colours due to their thickness variations (see microscopic picture in **Fig. 3**) – another limitation for the final pigment performance.

MIRAGE pigments are based on innovative artificial borosilicate platelets with well-defined characteristics. Thanks to excellent surface smoothness, uniform individual particle thickness as well as exceptional transparency, these achromatic flakes represent an ideal substrate for achieving optimum pearlescent effects (**Fig. 3**, right hand side).

The superior visual appearance of MIRAGE borosilicate pigments compared to traditional natural mica based pearlescent pigments stands out in a microscopic view (**Fig. 4**).

The titanium dioxide coated mica pigment with red interfer-

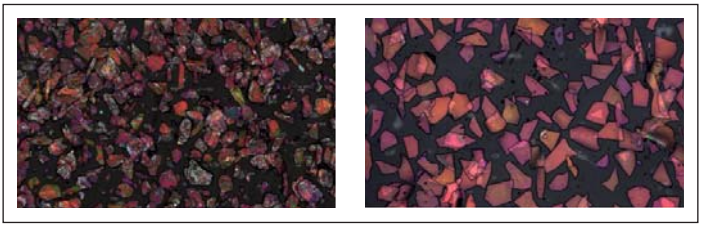

Figure 4: Traditional pearl pigment (left) vs. MIRAGE high performance pigment (right) in microscopic view.

ence colour on the left hand side shows a significant colour deviation from particle to particle caused by the background colour of individual mica flakes and by inhomogeneous metal oxide coating layer thickness. In contrast, the titanium dioxide coated borosilicate flakes on the right hand side appear in almost uniform red colour due to the achromatic nature of the artificial substrate and to the homogenous thickness of metal oxide coating achieved by superior coating technology.

MIRAGE high performance pigments vs. standard borosilicate pigments

Taking a closer look at available pearlescent pigments on the cosmetic market, it becomes obvious that MIRAGE pigments not only outperform traditional mica based effect pigments but also other comparable state-of-the-art borosilicate grades. This milestone in effect pigment performance is due to Eckart's proprietary technology leading to extremely smooth pigment surfaces which optimize gloss and offer unique colour purity (**Fig. 5**).

The microscopic view of MIRAGE Glamour Red (right hand side) effect versus a state-of-the-art borosilicate grade (left hand side) with red interference clearly illustrates the advantage of the MIRAGE pigments consisting of flakes of rather regular shape with only a few edges, very smooth and homogeneous titanium dioxide coating. On a macro scale, these characteristics allow optimum colour purity and maximum colour strength. In contrary, the effect of the customary grade shown left is significantly weakened by the colour

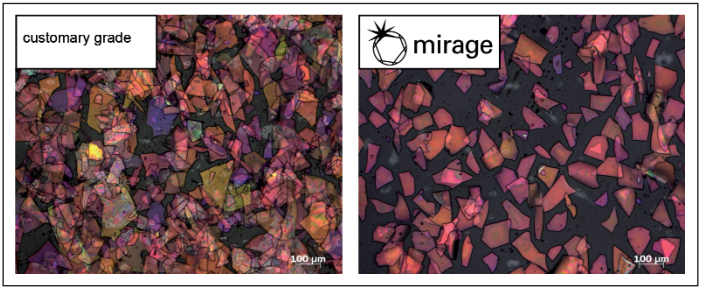

Figure 5: MIRAGE vs. standard borosilicate pigments (microscopic view).

deviations visible in the microscopic scale. The same principles apply for other interference colours of the MIRAGE product line, such as Glamour Gold, Blue or Green, each offering unique colour intensity and purity due to the homogenously coloured single particles.
Another important parameter contributing to the outstanding visual properties as well as to the excellent skin feel of MIRAGE pigments is their tightly controlled particle size distribution. This characteristic plays a key role in achieving high performance interference effects. Careful removal of the finest particles is essential to create the highest luster since these small particles strongly contribute to the creation of diffuse scattered light. Concerning sensory effects, even a small amount of oversized particles can negatively impact the skin feel. The MIRAGE borosilicate pigment range offers particle size fractions with an extremely narrow size distribution containing significantly less fine and coarse particles than customary grades in the market.

The importance & use of borosilicates in cosmetics

A field survey conducted with the Mintel database on new product launches containing borosilicate pigments over the last five years shows an interesting result:

Borosilicate pigments were found to be predominantly used in lip colour cosmetics. In 2008, the number of new

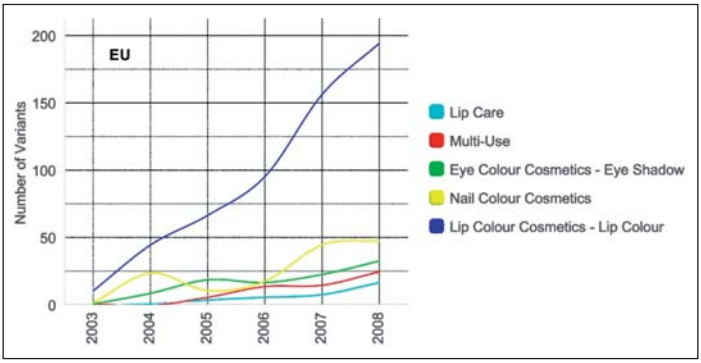

Figure 6: New products launched in Europe containing borosilicate pigments.

launches in Europe for this application field was four times higher than in nail or eye colour cosmetics (**Fig. 6**).
A similar picture emerges for Asia and US – again a significantly higher number of new product launches in the field of lip colour cosmetics is found.

MIRAGE borosilicates in cosmetic applications

In principal, the colouring options of MIRAGE borosilicates are comparable to mica based pigments, but due to their controlled and homogeneous particle thickness and high transparency, they exhibit much better colour purity and higher gloss, especially in transparent systems like lip glosses and gels. Thanks to their physiological harmlessness, borosilicate pigments are well suited for the use in any kind of colour cosmetic or personal care application. The MIRAGE pigment range offers a large palette of various visual effects. In order to benefit from this versatility, particle sizes and colours should be jointly considered (**Fig. 7**).
Depending on the particle size one can achieve very elegant and graceful effects when using particle size fractions around 15 - 70 µm and, in contrast to this, very luxurious and glittery effects when using coarse fractions containing particles with up to 150 µm. The final visual

Particle Size	Effect	Silver Effects	Interference Effects
15 – 70 µm	Graceful Effects	MIRAGE Bright Silver	
15 – 120 µm	Sparkle Effects	MIRAGE Sparkling Silver	MIRAGE Sparkling Luxury Gold
35 – 150 µm	Luxurious Effects	MIRAGE Glamour Silver	MIRAGE Glamour Gold MIRAGE Glamour Red MIRAGE Glamour Blue MIRAGE Glamour Green
100 – 700 µm	Glitter Effects	MIRAGE Twinkling Silver	

Figure 7: Particle sizes and effects.

effect in the cosmetic application not only depends on the chosen particle size, but also on the pigmentation level as well as on the characteristics of the application system. Very low pigmentation levels (0.01-0.6%) can be used in transparent systems, whereas higher pigment concentrations (1-3%) have to be used in opaque systems like waxes, lotions and the like.

For lipstick and lip gloss applications, pearlescent pigments based on borosilicates can be used in any systems to enhance the optics without regulatory limitations. Smaller particle size borosilicates can be used alone or in combination with other pigments at low use levels around 5% to enhance and support the luster of lip glosses or lipsticks leading to a ”water-shine” effect. When coarser particle size fractions are used, the resulting effect on the skin is highly sparkling and of less homogeneous shine as each single pigment particle can be detected by the human eye (***Formula:*** *Glossy Lipstick*). MIRAGE borosilicate pigments are recommended for use in emulsion systems to create highly glamorous and exceptional effects because of their transparency. Due to their synthetic origin, interference borosilicate pigments consist of a purely white powder and therefore do not influence the bulk colour of the final emulsion. However, the pigment loading strongly depends on the opacity of the emulsion and should be adjusted accordingly. Low concentrations are to be used in more transparent systems and higher pigment concentrations should be used in opaque systems (***Formula:*** *Water-in-Silicone Body Lotion*). The use

Glossy Lipstick - "Sheer Apricot"

Color Cosmetics

Ref: CC/0554/EU

Product Name	INCI Name	%W/W	Supplier
A		100.00	
Ewacera 34	Carnauba Wax	1.05	www.wagnerlanolin.de
Ewacera 12	Bees Wax	6.00	www.wagnerlanolin.de
Ewacera 42	Candelilla Wax	8.50	www.wagnerlanolin.de
Lipex Cocoasoft	Theobroma Cocoa Butter	6.50	www.aak.com
KP-561P	Acrylates/ Stearyl Acrylate/ Dimethicone Methacrylate Copolymer	3.50	www.shinetsu.co.jp
Walrath Synthetic	Cetyl Palmitate	3.60	www.kahlwax.de
Myritol 312	Caprylic/ Capric Triglyceride	6.20	www.cognis.com
Luvitol EHO	Cetearyl Ethylhexanoate	19.95	www.basf.com
Lipex L'sens	Soybean Glycerides (and) Butyrospermum Parkii	7.70	www.aak.com
Sebumol LPC	Lauryl PCA	3.00	www.zschimmer-schwarz.de
B			
dl-alpha-Tocopheryl Acetate	Tocopheryl Acetate	0.50	www.jandekker.com
Dow Corning 5562 Carbinol Fluid	Bis-Hydroxyethoxypropyl Dimethicone	24.50	www.dowcorning.com
C			
Prestige® Soft Fire-red	Mica (and) Iron Oxides	2.00	www.eckart.net
Prestige® Fire-red	Mica (and) Iron Oxides	2.00	www.eckart.net
MIRAGE Sparkling Silver	Calcium Borosilicate (and) Titanium Dioxide	5.00	www.eckart.net

Procedure

1. Weigh in phase A and heat up to 85°C
2. When phase A is melted weigh in phase B and heat up again to 85°C
3. Add phase C to phase AB and stirr until homogenous
4. Pour into a lipstick mould at 75°C

Water-In-Silicone Body Lotion - "Glamour Blue"

Skin Care

Ref: SC/0621/EU

Product Name	INCI Name	%W/W	Supplier
A		100.00	
Dow Corning 1501 Fluid	Cyclopentasiloxane (and) Dimethiconol	11.63	www.dowcorning.com
Dow Corning 245 Fluid	Cyclopentasiloxane	5.88	www.dowcorning.com
Dow Corning 5225C Formulation Aid	Cyclopentasiloxan/ PEG/ PPG-18/18 Dimethicone	13.93	www.dowcorning.com
Dow Corning AMS-C30 Cosmetic Wax	C30-45 Alkyl Methicone (and) C30-45 Olefin	3.58	www.dowcorning.com
B			
Tween 20	Polysorbate-20	0.73	www.uniqema.com
Sodium Chloride	Sodium Chloride	0.88	www.vwr.com
Water	Aqua	61.89	
C			
MIRAGE Glamour Blue	Calcium Sodium Borosilicate (and) Titanium Dioxide	1.00	www.eckart.net
Uniphen P-23	Phenoxyethanol (and) Methylparaben (and) Ethylparaben (and) Butylparaben	0.48	www.induchem.com

Procedure

1. Mix phase A and heat up to 75°C
2. Mix phase B and heat up to 70°C
3. Add phase B slowly to phase A while homogenisation
4. Cool down while stirring and add phase C step by step
5. Pour into an appropriate container

of scattering ingredients like titanium dioxide pigments can decrease or even destroy the shimmer effects.
If working with clear gels instead of opaque emulsion systems, the beauty about utilizing borosilicate pigments is that in most cases, very low use levels of even 0.1% will exhibit eye catching effects. Hence MIRAGE pigments can, for example, be used to formulate especially glittering and sparkling hair gels or body highlighting gels.

CONCLUSION

MIRAGE pigments offer superior colour purity and gloss effects which are highly relevant for transparent or glossy application systems like lip stick or lip gloss. Due to the high transparency of the MIRAGE pigment flakes, they are ideally suited for numerous cosmetic applications giving formulators the opportunity to create polychromatic effects.

Reference

[1] Pfaff, G., Spezielle Effektpigmente, Vincentz Verlag Hannover (2007).

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