BYK

QC SOLUTIONS FOR COSMETICS

Contents

The Objective Eye for Consistent Color and Appearance

Can you imagine the world of cosmetics without color, gloss or glitter? Brilliant or neutral colors underline a person's character and fashion style. Light and clean colors match a business outfit, while dark and sparkling colors are more for evening occasions.

Every year designers come up with new colors to create new looks and to differentiate their products. A variety of color shades are available to match a person's skin tone creating a "fresher, shinier" look or minimizing fine lines and small imperfections. The challenge is to find a precise and objective numerical measurement for the verbal descriptions used in the world of cosmetics.

Consistent color and appearance are crucial before as well as after sale. The visual impression during the first ten seconds will establish our perceptual quality opinion and be the driving factor in our purchasing decision. As important is reliable product performance over time, which is a reflection of customer satisfaction and hence the number of repeat purchases.

Visual color perception is influenced by our individual color preferences, which are dependent on personal factors (mood, age, gender etc.), environment (lighting, surrounding etc.) as well as our deficiency to communicate color and color differences. A color looks different in the department store (cool white fluorescent lighting) than at home (warm, incandescent lighting). Effect colors will even change their appearance depending on the type of daylight conditions being sunny or cloudy. In order to guarantee consistent color and appearance under all possible situations, it is essential to define numerical parameters with customer relevant tolerances, which can be controlled in daily production and communicated among the entire supply chain of raw material and final product suppliers. A high quality production process should only be based on figures and facts and not emotions.

Consistent color and appearance needs an OBJECTIVE EYE!

BYK-Gardner offers complete quality control solutions for your application in cosmetics.

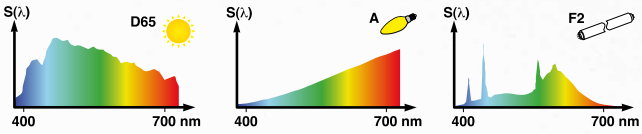
Color Measurement of Solid Colors

For a classic nail manicure, there is nothing quite like red. However, there are thousand shades of red: Ruby Red, Tomato Red, Blood Red, Jungle Bright Red, Dusty Pomegranate, Candy Apple Red ... – to just name a few. How to clearly differentiate the colors and guarantee the same red over time?

Our color perception is dependent on our individual "taste", which is influenced by our mood, gender, age, but also the light source used, the viewing environment being light or dark, neutral or colorful as well as our deficiency to exactly remember and communicate one specific color.

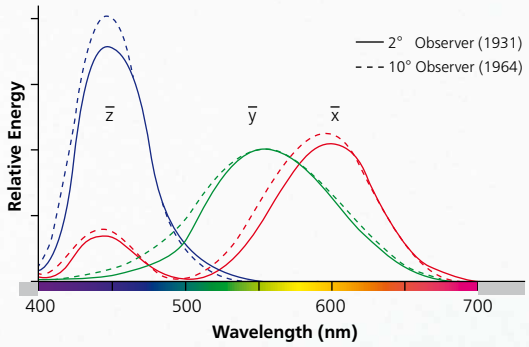
Standardized viewing conditions

For controlled visual and instrumental evaluation the light source, the surrounding and the observer are to be defined. Colors may match under one light source (daylight), but not under another (fluorescent light). Thus, the match needs to be verified with the kind of light likely to be found where the product is sold or used. The CIE (Commission Internationale de l'Éclairage) standardized commonly used **light sources**.



ISO and ASTM standards define the **surroundings** as portion of the visual field immediately surrounding the specimens as well as the ambient visual field, when the observes glances away from the specimen, such as the interior surfaces of the light booth. It shall have the color with Munsell notation N5-N7 and a 60° gloss not greater than 15 GU.

The **observer for visual appraisal** should have normal color vision and be trained in observing and classifying colors. Visual tests are recommended to check an observer's color vision periodically as it can change over time (see Guide ASTM E1499). The **observer for instrumental color control** was standardized with two different viewing fields: 2° standard observer and 10° standard observer. Today mainly the 10° observer functions are used as the eye integrates over a larger area.

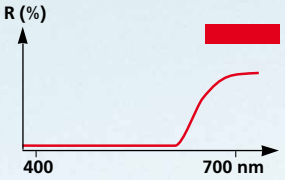


byko-spectra *pro*

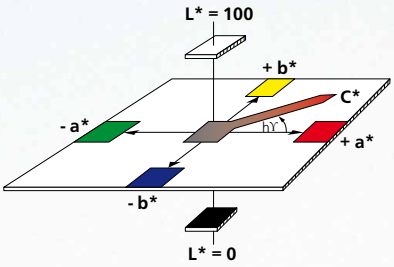
Light booth for standardized visual color appraisal

- Metamerism control – sample pairs can be evaluated under up to eight CIE illuminants D65/D75-A/HZ-CWF/TL84/U30-UV
- Excellent simulation of daylight D65 using halogen lamps combined with LEDs: CIE class A category
- Daylight lifetime lasts 600 hrs and change is automatically indicated
- Adjustable light intensity for optimum viewing of dark and light colors
- Automatic sequence mode for efficient metamerism evaluation

Standardized measurement parameters
For instrumental color measurement the optical properties of the product need to be measured. A spectrophotometer measures the amount of light that is reflected by the object at different wavelengths in the visible range (400 – 700 nm). The reflectance curve shows the spectral data and acts as a "finger print" for the object color.



Internationally standardized **color systems**, like the widely used CIELab system, combine data of standardized illuminant, standardized observer and spectral reflection data in three color components describing the lightness, hue and chromaticity of a color.

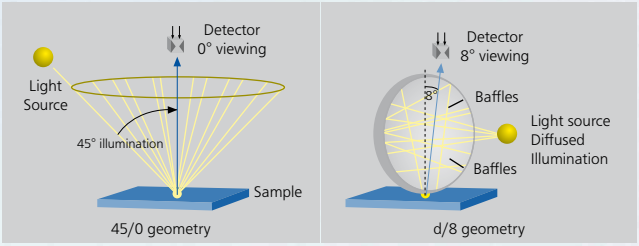


Tolerances are established either on each color component or on the total color difference ΔE*.

$$\Delta E^* = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$

Over the years new color systems and equations (ΔECMC – ΔE94 – ΔE99 – ΔE2000) were developed based on visual comparison studies for solid colors to improve the visual correlation, which shows elliptical tolerance behavior.

Standardized instrument geometries
International standards define the geometric conditions of spectrophotometers:

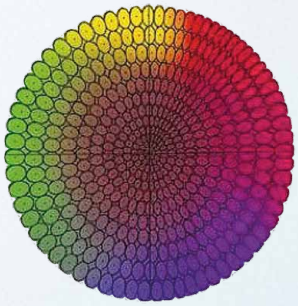


45/0 – Control color as you see it
For final QC of solid colors a 45° circumferential illumination is defined to achieve repeatable results on unstructured and structured surfaces.

d/8 – Control the hue of a color
If the color without influence of surface gloss or texture is to be controlled, diffused illumination is required.

References

CIE 15	Colorimetry
ISO 3668	Visual Comparison of the Color of Paints
ASTM D1729	Visual Appraisal of Color Differences



Tolerance Ellipsoids in CIELab Color Space

spectro2guide
The revolution in portable color control

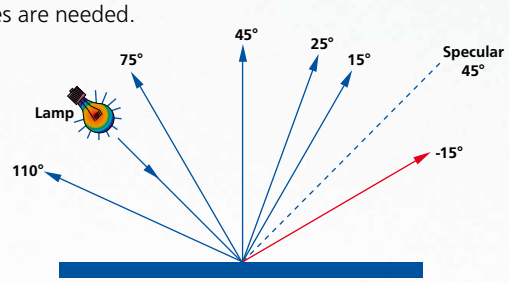
- Color, gloss and new fluorescence measurement in one instrument
- Balanced and upfront design with large 3.5" color touchscreen
- Docking station with built-in standard for automatic calibration
- Live preview of measurement spot with zoom function
- Smart high tech LEDs with peak performance for Digital Standards
- Data analysis out-of-the-box with WiFi or USB connection

Color Measurement of Effect Colors

There is a huge trend towards cosmetic products that sparkle like diamonds or fascinate with a metallic glamorous look.

Multi-angle color evaluation
In contrast to solid colors, effect finishes change their color and appearance with viewing angle and lighting conditions. Metallic finishes will show a lightness travel depending on the viewing angle. Pearl colors with special interference pigments can not only show a lightness change with different viewing angle, but also a change in chroma and hue (color travel).

International standards define measurement geometries for multi-angle color measurement to objectively describe the color of metallic finishes. Research studies show that a minimum of three, and depending on the effect finish up to six viewing angles are needed.



As the color perception of effect finishes is changing by viewing angle it is necessary to define different tolerances for each viewing angle. Therefore, new color equations based on visual correlation studies were developed:

- ΔE94 with lightness travel (Rodrigues, 2004)
- ΔE_{eff} (DIN 6175-2, 2001)
- ΔEAudi2000 (Dauser, 2012)

Visual effect evaluation
The latest developments are special effect pigments, which create high sparkling effects under direct illumination. Viewed under diffused lighting conditions the sparkling effect will disappear as the light intensity is equal from all directions. Therefore, metallic pigments will look more or less grainy depending on the flake size and a pearl will look more like a solid color. Under direct illumination, i.e. the light intensity comes from mainly one direction (sunny sky), the same metallic or effect finish will look completely different showing small light flashes with low to high intensity. In contrast to graininess, the sparkle effect is depending on the illumination angle resulting in a sparkle travel.

References

DIN 6175-2 Tolerances for Automotive Paints – Part 2: Goniochromatic Colors

ASTM E2194 Multiangle Color Measurement of Metal Flake Pigmented Materials

byko-spectra *effect* light booth

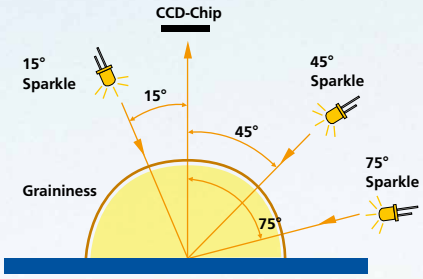
Standardized visual evaluation of effect finishes

Multi-angle color evaluation
- Daylight illumination at 45°
- Tiltable sample table with six viewing angles (-15°, 15°, 25°, 45°, 75°, 110°)
- Timer to track daylight lamp usage

Sparkle evaluation
- Illumination at three angles (15°, 45°, 75°)
- Very bright LEDs to simulate direct sunlight
- 10 year warranty on LEDs

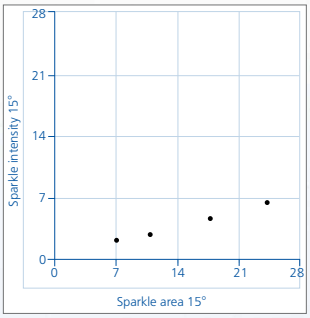
Instrumental effect measurement
In order to objectively measure effect characteristics, the new BYK-mac i combines a multi-angle spectrophotometer (6-angle color measurement) with a second measurement set-up for sparkle and graininess evaluation. A CCD camera takes pictures under various lighting conditions:

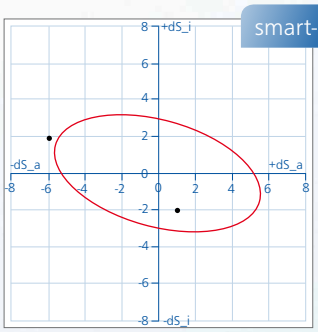
- Diffused illumination with two white LEDs built-into a white coated hemisphere
- Direct illumination at three angles with three white super bright LEDs



The pictures are analyzed using the histogram of lightness levels of the individual pixels as the base information. The uniformity of light and dark areas is summarized in one graininess value. A graininess value of zero would indicate a solid color. The higher the value, the grainier or coarser the sample will look under diffused light.

In case of sparkling, a threshold is set and only the very bright pixels above the threshold are evaluated. To allow a better differentiation, the impression of sparkle is described by a two dimensional system: sparkle area and sparkle intensity for each angle.





smart-lab

A sparkle tolerance model was developed, which allows setting a maximum limit value for "Delta Sparkle" similar to a weighted total color difference equation.

$$dS = \sqrt{\left(\frac{f_1(Sa_{Std}, dSa, Si_{Std}, dSi)}{Tol\_Gr}\right)^2 + \left(\frac{f_2(Sa_{Std}, dSa, Si_{Std}, dSi)}{Tol\_Gr \times Tol\_GF}\right)^2}$$

BYK-mac i
Portable multi-angle color & effect control

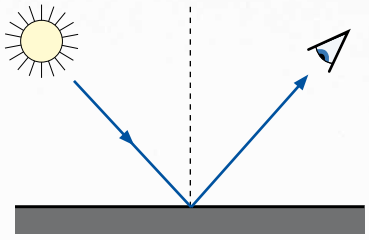
- 6-angle color measurement for light-dark and color flop
- Sparkling and graininess analysis
- Detection of fluorescent light excited in the visible range
- Unique LED technology
  → Excellent technical performance
  → No need for lamp exchange
  → The key to a global QC system using digital standards

Gloss Measurement

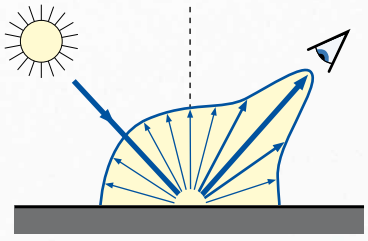
Lipstick or lip gloss? It is a matter of taste: some like it glossy - some prefer it matte. What counts however is the consistent quality and appearance of the customer's favorite product.

Gloss measurement

Gloss is a visual impression dependent on the surface condition. The more direct light is reflected, the more obvious the impression of gloss will be. A lip gloss will make our lips look wet and having a very smooth surface. The incident light is directly reflected on the surface, i.e. only in the main direction of reflection. The angle of reflection is equal to the angle of incidence.

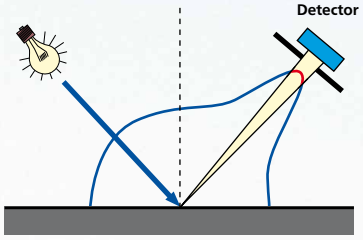


A matte lipstick includes matting agents, which produce a micro roughness scattering the light diffusely in all directions. The more uniform the light is scattered, the less intense the reflection will be in the main direction. The surface will appear more and more matte.



Gloss meter

International standards define the measurement of specular reflection with a gloss meter. The light intensity is measured over a small range of the reflection angle.



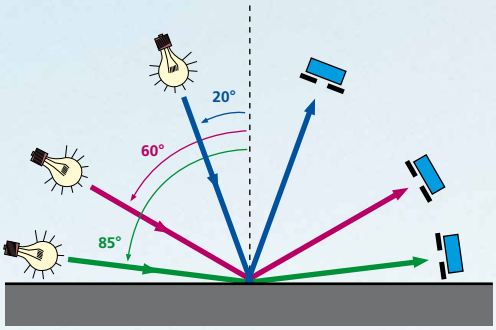
A light source, simulating CIE illuminant C, is placed at the focal point of a collimating lens. A receptor lens with an aperture in the focal plane followed by an illumination detector completes the basic optical design.

The intensity is dependent on the material and the angle of illumination. The measurement results are related to the amount of reflected light from a black gloss standard with a defined refractive index. The measurement value for this defined standard is equal to 100 gloss units. Materials with a higher refractive index can have a measurement value above 100 gloss units (GU).

References

ISO 2813	Determination of Specular Gloss of Non-Metallic Paint Films at 20°, 60°, 85°
ASTM D523	Standard Test Method for Specular Gloss

The angle of illumination is of high influence. In order to obtain a clear differentiation over the complete measurement range from high gloss to matte, three geometries, i.e. three different ranges, are standardized:

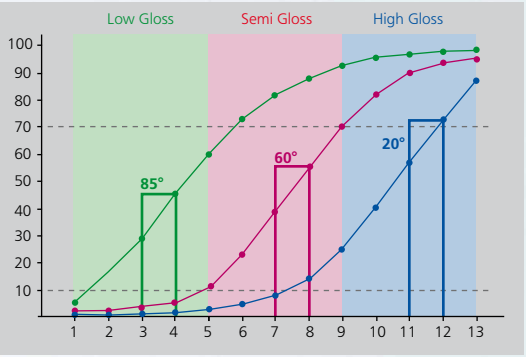


Why three different gloss ranges?

A single measurement geometry, such as 60°, may not provide instrument readings of gloss that correlate well with visual observations when comparing different gloss levels. This is why international standards provide for measurement at three different angles of incidence, namely 20°, 60°, and 85°. Each of the three geometries uses the same source aperture, but a different receptor aperture. The choice of geometry depends on whether one is making a general evaluation of gloss, comparing high gloss finishes or evaluating low gloss specimens for sheen. The 60° geometry is used for comparing most specimens and for determining when the 20° or 85° geometry may be more applicable. The 20° geometry is advantageous for comparing specimens having 60° gloss values higher than 70. The 85° geometry is used for comparing specimens for sheen or near grazing shininess. It is most frequently applied when specimens have 60° gloss values lower than 10.

Gloss level	60° value	Recommended geometry
Semi gloss	10 to 70 units	60° geometry
High gloss	> 70 units	20° geometry
Low gloss	< 10 units	85° geometry

In a case study 13 samples were visually ranked from matte to high gloss and measured with the three specified geometries. In the steep slope of the curves, the differences between the samples can be clearly measured, while in the flat part the measurement geometry no longer correlates with the visual perception.



micro-gloss

The new intelligence in gloss measurement

- Unsurpassed industry standard in gloss measurement
- 1- angle and 3-angle gloss meters for high gloss to matte finishes
- Automatic calibration check in holder
- Measurement modes for any task: Statistics – Difference – Pass/Fail
- Continuous mode for uniformity check of large surface areas
- Wireless data transfer

Transparency Measurement

The "Forever Young Trend" in today's society produces an even higher need to develop new ways and products to create a flawless look. Therefore, the cosmetics industry created the so-called "soft focus effect".

Soft focus effect
The term "soft focus" originally comes from photography where soft focus is a lens flaw, in which the lens forms images that are blurred due to spherical aberration. A soft focus lens will blur the image while retaining sharp edges.

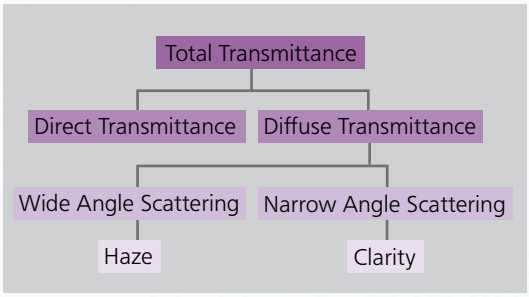
In the cosmetics industry the soft focus effect is used in anti-aging creams and make-ups. Skin imperfections such as fine lines and wrinkles cause the skin to appear uneven by trapping light in the micro crevices formed by the wrinkles. The trapped light is consequently absorbed and generates dark spots that show on the skin.

Specialty pigments, e.g. platelets of transparent alumina coated with a thin layer of titanium dioxide, are designed to create this soft focus effect by uniform light diffusion on the skin surface. Wrinkles and fine lines are masked as the particles prevent light from becoming trapped. Thus, light is allowed to pass through (transparency) and scatter in many directions (diffused transmittance) onto the skin. As a result light reflection occurs uniformly from many points of the skin, thereby maintaining the natural skin tone and making wrinkles less visible.

In order to achieve this effect, the soft focus particles should exhibit the following properties:

- High amount of total light transmittance to reflect the natural skin tone through the particles
- Maximal diffused transmittance component to evenly distribute the light reflected from the skin hiding imperfections

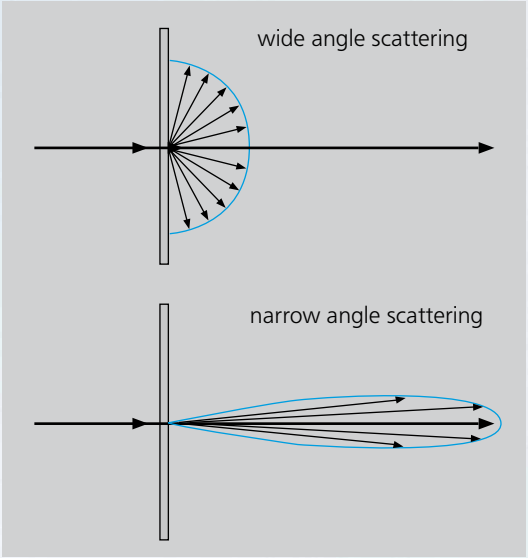
Transparency measurement
The appearance of a transparent/translucent product is described by the following optical properties:



The total transmittance is the ratio of transmitted light to the incident light. It is influenced by the absorption and reflection properties, e.g.:

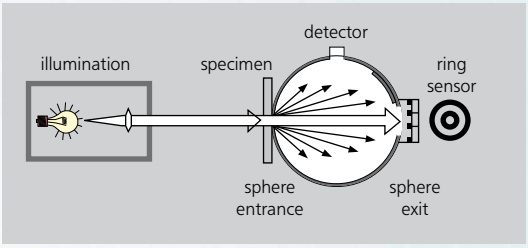
Incident light	100 %
- Absorption	1 %
- Reflection	5 %
Total Transmittance	94 %

The totally transmitted light consists of the directly transmitted and the diffused components. Depending on the scattering behavior of the diffused light, the products viewed through the transparent film will appear differently. If the diffused component is scattered in a narrow angle range (deviation from incident beam less than 2.5°), fine details are blurred. While scattering in a wide angle range (deviation from incident beam greater than 2.5°) will reduce the contrast of objects viewed through the transparent material.



Measurement principle

The figure on the right shows the measurement principle of the BYK-Gardner haze-gard i in compliance with international standards. A light beam strikes the specimen and enters an integrating sphere. The sphere's interior surface is coated uniformly with a matte white material to allow diffusion. A detector in the sphere measures total transmittance and transmission haze. A ring sensor mounted at the exit port of the sphere detects narrow angle scattered light, a measure of clarity.



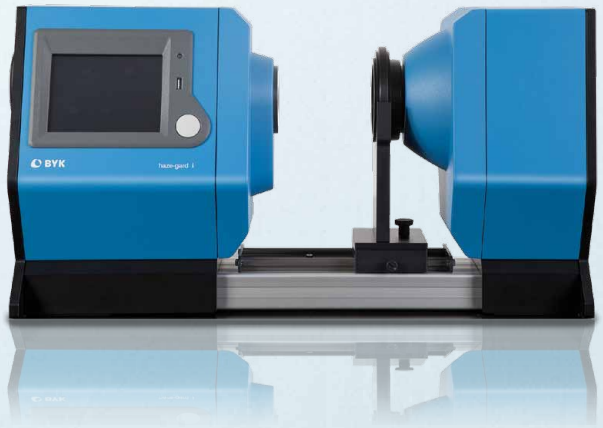
References

ISO 13468	Determination of the Total Luminous Transmittance of Transparent Materials
ISO 14782	Determination of Haze for Transparent Materials
ASTM D1003	Haze and Luminous Transmittance of Transparent Plastics

haze-gard i

The industry standard for transparency

- Three measurements in one:
  Total Transmittance – Transmission Haze – Clarity
- Repeatable results guaranteed due to reference beam and innovative LED technology
- Open design for small and large specimens
- Large touch display in color for onboard analysis
- Versatile sample holder for films and sheets
- ASTM and ISO: two standard methods in one unit



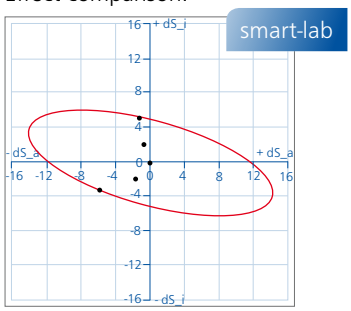
Pigment Characterization

New fashion looks are presented in color shows of pigment manufacturers to cosmetic companies every year. Pigment manufacturers enhance their portfolio and offer alternative pigments to already selected pigments. Now the cosmetic company is faced with the task to objectively evaluate the technical, aesthetic and financial benefits of the presented pigments. Objective measurement of color and appearance attributes will help in the selection and approval process to determine cost efficient alternatives or launch a new look.

Build-up of a pigment database
Similar to computer color matching set-ups, a database has to be developed, which will contain all of the company's available pigment types. This database should contain search attributes, which will not only describe aesthetic, but also technical and financial features. In order to characterize the aesthetic attributes of a pigment type a standardized sample preparation method needs to be established. One possibility is to incorporate the pigment in a solution to create a drawdown. Similar to the application of nail polish a quick drying base can be used and applied on a high quality contrast chart (byko-chart) using a wire bar with appropriate wet film thickness (see nail polish).

Comparison of pigments with similar looks
Using BYK-Gardner smart-lab software in conjunction with a pigment database helps cosmetic companies in the evaluation process of new pigments. The new pigment is measured as standard and compared to similar pigments saved in the database.

Effect comparison:



Data interpretation
The difference graph above shows that the sparkle ability of the new pigment (center) is similar to the other four pigments, which were already part of the cosmetic company's pigment portfolio. They are all located within the defined tolerance area meaning no visual difference can be perceived.

By comparing color and effect data of new pigments to the existing product range a quick decision can be made whether the investment in this new pigment is worth it or not.

BYK-Gardner Solution

Solid Color & Gloss
spectro2guide

Multi-Angle Color & Effect
BYK-mac i

Gloss
micro-gloss

Visual evaluation of drawdowns: byko-spectra *effect*
In the end, the final judgment will always include a visual evaluation. The key to an objective visual check is standardized viewing conditions including lighting, observing angles and surroundings. The byko-spectra *effect* uses a daylight light source and allows visual color appraisal under six angles (-15°, 15°, 25°, 45°, 75°, 110°) and sparkle evaluation under three angles (15°, 45°, 75°). Depending on the lightness of the samples the sparkle illumination is dimmable to get the best visual impression.

Drawdown Test Charts
byko-charts

Applicators
Wire-wound rods

Objective Visual Evaluation of Effect Finishes
byko-spectra *effect*

Measurement of Nail Polish

Nail polish can be transparent, translucent or totally opaque. By adding metallic or interference pigments fascinating effects can be achieved. In order to guarantee consistency, a routine quality control system needs to be established. Key component is one binding reference with realistic tolerances, which allows evaluating batch to batch variation. In order to obtain repeatable results, standardized sample preparation is crucial.

Measurement of nail polish on test charts
An easy and quick test method for nail polish is applying a thin film on a black and white chart. In order to create a uniform drawdown, the following points are of importance:

- Influence of substrate
- Wet film thickness applied
- Uniform film thickness

The use of BYK-Gardner byko-charts, drawdown cards, guarantees consistent color and gloss of the substrate ensuring that the measured color difference only comes from product variations. Applying opaque nail polish on black and white charts also allows evaluation of opacity (hiding power).

For uniform application and good pigment orientation wire bars are the best choice. The choice of wire bar and therefore, wet film thickness depends on the mean particle size of the pigment. Selecting the wet film thickness close to the mean particle size will avoid a disorientation of the pigments and force the particles to orientate parallel, which will be close to the final application method by brush. The visual result will be similar to the final application on fingernails.

A uniform film thickness can be best achieved by using an automatic film applicator. Draw down speed and pressure on the applicator tool will always be the same. During routine quality control only measurement results of drawdowns using the same wire bar size should be compared. If however color and effect measurements of a wide variety of particles needs to be compared, drawdowns should be made with varying film thickness. The reason is that a difference in particle size as well as particle thickness will result in a different particle mass i.e. loading degree, opacity level and viscosity. Hence, for each pigment class the optimum film thickness should be determined according to their optimum visual performance prior to comparing measurements.

Measurement of nail polish on artificial fingernails
A classic QC method for final color and effect inspection is to compare the colors on the two thumbnails, holding them side by side. As this test result can only be evaluated visually, the use of artificial acrylic nails is an alternative method, which can be easily standardized.

The challenge for instrumental color and effect measurement is the small size and curved surface of the fingernails. Therefore, a color instrument with small aperture and a repeatable sample placement is required. BYK-mac i 12 mm together with the sample holder cosmetics and the nail kit (see page 23) is the ideal solution to guarantee repeatable results.

BYK-Gardner Solution

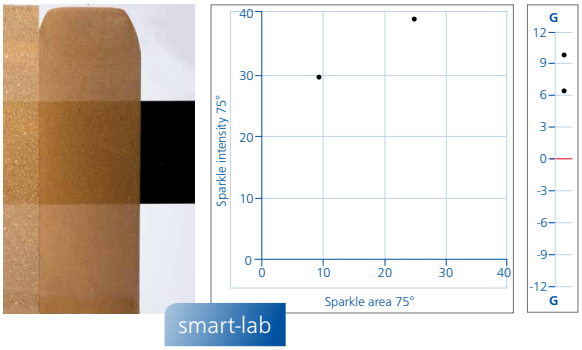
Solid Color & Gloss
spectro2guide

Multi-Angle Color & Effect
BYK-mac i

Gloss
micro-gloss

Comparison of two nail polish formulations

Not only does the application method influence the pigment orientation and hence, appearance, but also changes in formulation can create different looks. In the following example the same pigment was used in two different formulations. In formula 1 the flake orientation was not influenced. As a result it looks coarser and sparkles at a low grazing angle. In formula 2 the aluminum flakes were oriented parallel creating a fine, mirror-like look with hardly any graininess.



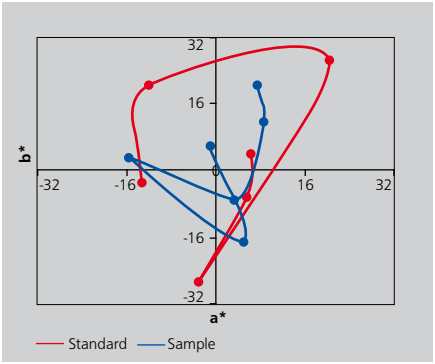
Data interpretation

BYK-mac i effect measurements show clear differences. Graininess values and sparkle 75° values are significantly different. In case of severe disorientation of aluminum flakes, graininess as well as the sparkle area at 75° will be increased. The results agree very well with the visual evaluation.

Color travel of silver pearl nail polish

Depending on the pigment types used light-dark travel or color travel can be created when viewing at different angles. In case of interference pigments creating a color flop/travel the lightness and colorimetric data will change by viewing angle.

Two silver pearl nail polishes were measured with a BYK-mac i:



Data interpretation

The absolute L*, a*, b* graph displaying all angles in one diagram shows clearly the flop behavior (-15°, 15°, 25°, 45°, 75°, 110°) for the two products. The standard exhibits an extreme color flop with an interference line travelling through all four quadrants. It represents a color travel from yellow over red and green to blue.

Automatic Film Applicator
byko-drive

Drawdown Accessory
byko-charts & wire-wound rods

Artificial Nail Accessory
Sample Holder Cosmetics

Lipstick Quality at Every Production Stage

On its way to the final product a lipstick passes many different physical states ranging from liquid over pasty to the molded final stick. Consistent lipstick quality can only be guaranteed, if every production step is controlled. BYK-Gardner offers the complete solution for measuring liquid and pasty materials as well as the final product quality of the lipstick.

Lipstick is made of dyes and pigments in a fragrant oil-wax base. Pigments are first dispersed in an oil base, then added to an oil/wax phase and mixed until a homogeneous product has been achieved. Last, effect pigments like metallic or pearlescent pigments may be added to obtain high effect colors. The final lipstick paste is then either molded, or it is poured into pans and stored for future molding. In case of the lipstick mass being stored before it is poured and molded, it must be reheated, checked for color consistency (color bleeding) and adjusted to specifications.

Due to the complex production process an objective QC system is needed to guarantee a high quality product at the end. Realistic color and gloss tolerances need to be set up for each production step. High quality color and gloss meters with excellent repeatability and inter-instrument agreement are needed to assure efficient communication among the different production phases, which might also include various suppliers. And standardized sample preparation methods need to be established to ensure uniform sample surfaces.

Measurement of pigment paste

For a quick and efficient quality control of the pigment paste it is necessary to measure the paste in a liquid stage. Therefore, it needs to be stirred thoroughly and poured into a cup. For ease of handling a special sample holder was developed, which can be easily cleaned and comes with disposable plastic spoons. For repeatable results the same amount of pigment paste needs to be poured into the spoon by means of a syringe. Care must be taken to achieve a smooth and homogeneous surface. The sample holder is designed for non-contact measurement by placing the BYK-mac i on a mask to ensure centered positioning. A light barrier prevents entry of ambient light.

Measurement of lipstick paste

After adding the wax phase the final lipstick material will be very viscous. In order to control color/effect and gloss of this high viscous material either the mass is measured in a sample holder with round dishes (see powders and creams) or a drawdown is made on a test chart. Applying the lipstick on a test chart will be closer to simulating the color of the lipstick as it is applied on the lips. The following best practice can be applied for making a drawdown of the lipstick paste:

1. Heat lipstick paste in a water bath to decrease the viscosity.
2. Stir lipstick paste for uniform dispersion shortly before applying.
3. Heat applicator and substrate plate to keep a low viscosity and avoid freezing of the paste; a square applicator is recommended as it shows best drawdown results.
4. Use an automatic film applicator, as the draw down speed and pressure on the applicator tool will always be the same.

A special wet drawdown template was developed for placing the color or gloss instrument onto the sample without contact. For ease of handling the template is made of easy-to-clean hard-anodized aluminum.

BYK-Gardner Solution

Solid Color & Gloss
spectro2guide

Multi-Angle Color & Effect
BYK-mac i

Gloss
micro-gloss

Automatic Film Applicator
byko-drive

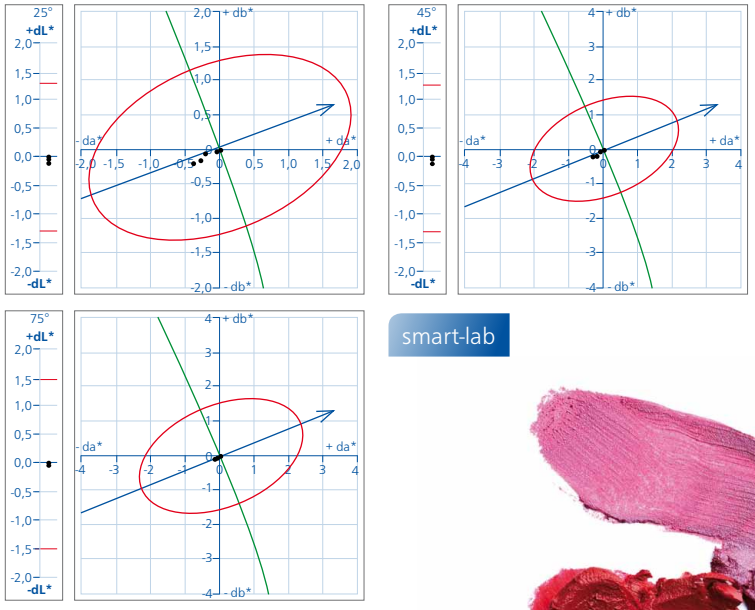
Measurement of lipstick
After the lipstick is molded in its shape, it is flamed to seal pinholes and improve the finish. At this point, color is of high importance as now the lipstick is in its final production stage, being ready to be sold to the customer.

The difficulty in measuring the color of a lipstick is the high curvature and the pasty material. Therefore, the sample holder cosmetics together with the lipstick kit was developed. Thus, the lipstick in its compartment can be easily positioned for color analysis and a mask ensures non-contact measurement (see page 23).

Repeatability check: Measurement of lipstick
The same red metallic lipstick was measured 5 times by taking 3 readings each time. After the first 3 readings the lipstick was taken out of the holder and put back into it.

Data interpretation
The data was analyzed using dECMC tolerances. As can be seen on the graphs on the right, the repeatability of the five measurements is well within the defined specification. Prerequisite is a uniform sample surface.

Color:



smart-lab

Pigment Paste Accessory
Sample Holder Liquid Paste – for BYK-mac i

Wet Drawdown Accessory
for spectro2guide / micro-gloss / BYK-mac i

Lipstick Accessory
Sample Holder Cosmetics

Consistent Quality of Powders and Creams

Eye shadows are produced as powder or creamy product. Colored facial products are available highly viscous lotion or a foundation, which is often finished with a facial pressed powder. Finding the right skin tone takes time and once selected it is expected to be the same at each purchase.

Color consistency is a key quality criterion for a successful product with a long lifetime. Powders, pastes and liquids can either be measured in mass or in case of lower viscosity products as drawdowns on test charts. In both cases a non-contact measurement technique will be the preferred method since this technique correlates best with how the consumer perceives the final product in the store.

Measurement of powders
Powdery eye shadow and facial powder are pressed in “shape”. For production quality control a standardized technique needs to be established in order to always maintain the same plunger pressure as well as the same plunger tissue. It is recommended to use a fine-woven fabric, which will leave no or as fine as possible texture on the surface. A smooth and non-textured surface allows an objective measurement of the color hue and the sparkling behavior of effect pigments.

For this purpose a sample holder with disposable round dishes was especially designed. The powdery material is filled and pressed based on a standardized technique into the disposable dish. The sample holder comes with an adapter ring for a cup size ø 35.5 mm, height 4.5 mm. To use the holder with other cup sizes, customized adapter rings are offered with a maximum cup size of ø 60 mm.

The holder is available with different instrument masks to allow objective color and gloss measurement.

The instrument mask is custom made to fit the aperture of the respective instrument guaranteeing repeatable sample placement and measurement results as well as non-contact measurement to protect the instrument's optic.

Measurement of creamy eye shadow or other products with high viscosity
The same sample holder with a round dish as described for powdery products can be used. An alternative would be the sample holder liquid paste (see lipstick), which can also be easily cleaned and comes with disposable plastic spoons instead of a round dish. For repeatable results the same amount of paste needs to be poured into the round dish or spoon by means of e.g. a syringe. Care must be taken to achieve a smooth and homogeneous surface. Both sample holders are designed to ensure a non-contact measurement of the material by placing the instrument on a mask to ensure centered positioning. A light barrier prevents entry of ambient light.

Please note that measurements through a glass plate or in a closed glass cuvette do not correlate with the perceived color. The glass cover will change the color and gloss measurement results. Therefore, a non-contact measurement is the better measurement choice.

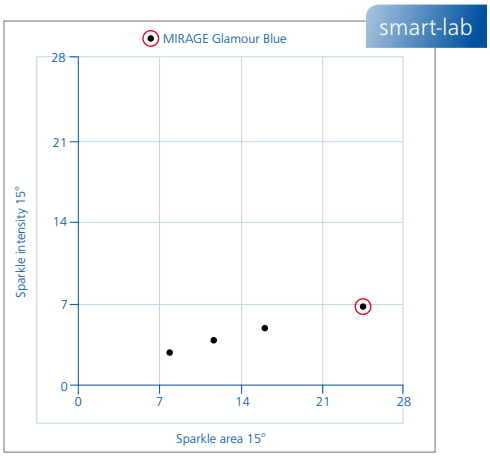
BYK-Gardner Solution

Solid Color & Gloss
spectro2guide

Multi-Angle Color & Effect
BYK-mac i

Gloss
micro-gloss

Effect evaluation of creamy eye shadow
Eye shadow using the new MIRAGE effect pigment line from ECKART was compared to products using natural mica based pigments. MIRAGE pigments will create a glamorous look and extraordinary sparkling effect.



Data interpretation
BYK-mac i measurements of MIRAGE Glamour Blue show a much higher sparkle area and sparkle intensity value than a traditional mica pigment.

Measurement of liquid foundations
Foundations often have a low to medium viscosity and therefore, can either be measured in mass (see measurement of creamy eye shadow) or as a drawdown on a test chart. Applying the foundation on a black and white chart can give additional information on hiding power (opacity). The following best practice can be applied for making a drawdown of foundation:

- Stir foundation paste for uniform dispersion shortly before applying.
- Use automatic film applicator as draw down speed and pressure on the applicator tool will always be the same.

A special wet drawdown template was developed (see lipstick) for placing the color or gloss instrument onto the sample without contact. For ease of handling the template is made of easy-to-clean hard-anodized aluminum.

Pigment Paste Accessory
Sample Holder Liquid Paste – for BYK-mac i

Powders & Creams Accessory
for spectro2guide / micro-gloss / BYK-mac i

Analysis of Soft Focus Products

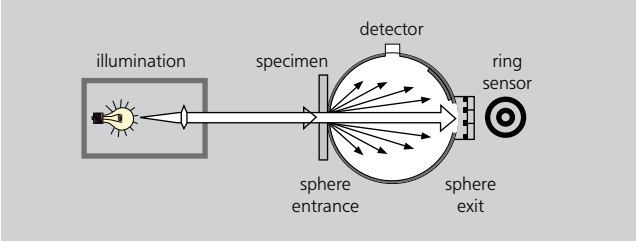
In the cosmetics industry the soft focus effect is used in anti-aging creams and tinted lotions. The idea is to diminish skin imperfections such as fine lines and wrinkles and to create a "flawless", but at the same time "natural" look. Therefore, the lotion should have a high percentage of both Total Transmittance and Transmission Haze. The BYK-Gardner haze-gard i helps to achieve the goal of developing a highly efficient soft focus product.

There are many different factors like chemical composition, size, shape and porosity of a particle, which are influencing its ability to exhibit a soft focus effect. The more light is scattered, the higher will be the diffused transmittance component. And then the soft focus effect will be most effective. In addition, a high total transmittance will ensure that a more natural look is obtained. An easy and objective method for fast screening of microspheres for this effect is using a haze meter to measure the total transmittance and haze (diffused transmittance component) of particles dispersed in a film and applied on e.g. a glass plate or a transparent film.

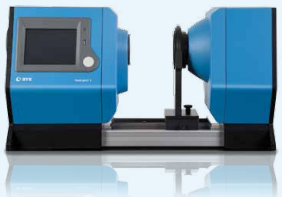
Measurement of soft focus particles

For total transmission and haze measurements, the soft focus particles are dispersed in a base medium and a uniform drawdown is made either on a glass plate or crystal clear polyester film. An automatic film applicator is recommended as the draw down speed and pressure on the applicator tool will always be the same.

For measurement the drawdown film is placed in front of the sphere component of the BYK-Gardner haze-gard i. As the light beam strikes the specimen, part of the light will be transmitted and enters an integrating sphere. The sphere's interior is coated uniformly with a matte white material to allow diffusion. A detector in the sphere measures total transmittance and transmission haze.



BYK-Gardner Solution



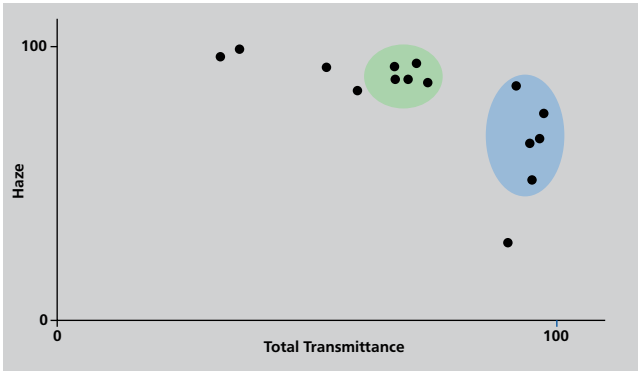
Transparency
haze-gard i

haze-gard i Feature
Film holder

Evaluation of potential soft focus particles
Using BYK-Gardner haze-gard i in conjunction with the smart-lab haze software a variety of different particles can be quickly compared in regards to their potential usage in soft focus products. The measurement of total transmittance and haze are both obtained by just pressing one button on the haze-gard i.

Data interpretation
The graph below shows haze versus total transmittance of different pigment types and particle sizes. The particles belonging to the "blue and green group" exhibit high enough haze and total transmittance to be considered as potential soft focus particles. Particles in the "blue group" are extremely translucent. Light is able to pass through these particles and reflect from the skin maintaining the natural skin tone. Hence particles in the "blue group" are ideally used in skin care products, which diminish wrinkles and small imperfections resulting in a very natural look.

Particles in the "green group" show very high haze. Light passing through is scattered in many directions by those particles, which leads to reflection occurring from many points of the skin. The result is a softening of the fine features of the skin. As the "green group" particles, however, are not as highly translucent, they are better suited for use in foundation make-up giving an optimum natural looking coverage.



Automatic Film Applicator
byko-drive

Applicators
Wire-wound rods

Transparent Drawdown Test Charts
byko-charts polyester film

Quality Control of Cosmetic Packaging

Wikipedia says: "Packaging is the technology of enclosing or protecting products for distribution, storage, sale, and use." In many markets like cosmetics, packaging is much more than that. The packaging needs to be not only functional but also attractive. Packaging which is beautiful and looks expensive influences the consumer's purchasing decision.

Basically all beauty products – hair care, skin care, sun care, color cosmetics, fragrance, bath and body, etc. – can benefit from added-value packaging. Main features of the product can be reflected in its packaging and trigger feelings. For example, metallic cans for hairstyling products promising a glamorous look.

Measurement of cosmetic packaging

For expensive looking, high quality packaging with maximum shelf impact it is important that only those batches leave factory, which are of consistent color and appearance. BYK-Gardner's instruments make sure that the precise color, effect and appearance specifications are met every time.

There are many ways of preparing packaging samples for taking measurements. The easiest situation is when dealing with packaging, that is the ideal shape and size. Packaging with flat and adequately sized areas, that fit the aperture of the instrument perfectly, can be measured by directly bringing the instrument in contact with the packaging. In case of flexible plastic packaging, e.g. a plastic shampoo bottle, one possibility is to cut through the sample and lay it flat. This way the sample is transformed from a 3-D shape into a 2-D shape and again measurements can be taken by direct contact with the aperture of the instrument.

One challenge is the measurement of cylindrical shaped packaging. It is rather difficult to achieve repeatable instrument positioning when measuring curved samples, which is the pre-requisite for reliable results. As a result BYK-Gardner developed the sample holder cosmetics with a cylinder kit. The sample holder is constructed like a drawer to prevent ambient light from influencing the measurement results. Customized inlays inside the drawer hold the cylinders in place. The holder comes with three different masks which fit the apertures of the BYK-mac i, the spectro2guide or the micro-gloss.

BYK-Gardner Solution

Solid Color & Gloss
spectro2guide

Multi-Angle Color & Effect
BYK-mac i

Gloss
micro-gloss

The NEW Sample Holder Cosmetics

Drawer-like Design
The sample holder cosmetics is designed like a drawer, which can be comfortably opened and closed. Magnets keep the drawer from sliding open.

- Sample drawer for easy product placement
- Secure positioning allows readings always at the same spot
- Covers entire measurement area

→ Repeatable & reproducible readings guaranteed

Extremely Versatile
A variety of products can be measured: Lipstick, fingernails, hairspray cans... No matter which product you need to control - the new sample holder cosmetics will be your solution.

Lipstick Kit
- Prismatic clamp for inserting lipsticks with various diameters
- Magnets on bottom plate for reliable locking, simple attachment and removal

Nail Kit
- Exchangeable nail attachment, which is customizable for various nail shapes
- Reliable rigid placement via magnets on bottom plate

Cylinder Kit
- Customizable inlays for various diameters of cylindrical shaped products
- Optimum form closure guarantees tight fit of inlays inside the holder

→ Reliable QC for a variety of high quality products

Completely Shielded
The drawer-like structure equipped with a special mask, which is precisely fitting the color or gloss instrument in use, enables measurements of your samples in a completely shielded compartment.

- No ambient light
- Special, exchangeable masks for color & gloss control
- Durable, easy-to-clean material

→ High quality readings ensuring high quality production processes

Packaging Accessory
Sample Holder Cosmetics

BYK-Gardner Cosmetic Solutions

Pigments

Drawdown of dispersed pigments	**Accessory** • byko-drive • Wire-wound rods • byko-charts

Nail Polish

Drawdown of nail polish	**Accessory** • byko-drive • Wire-wound rods • byko-charts
Artificial fingernail	• Sample Holder Cosmetics • Nail Kit

Lipstick

Pigment paste	**Accessory** • Sample Holder Liquid Paste • Sample Holder Round Dish
Drawdown of lipstick paste	• byko-drive • Multiple Clearance Square Applicator • byko-charts • Wet Drawdown Template
Lipstick	• Sample Holder Cosmetics • Lipstick Kit

Powders & Creams

Powder or creamy product	**Accessory** • Sample Holder Round Dish • Sample Holder Liquid Paste
Drawdown of liquid foundation	• byko-drive • Wire-wound rods • byko-charts • Wet Drawdown Template

Soft Focus Products

Drawdown	**Accessory** • byko-drive • Wire-wound rods • byko-charts polyester film

Packaging

Final product	**Accessory** • Sample Holder Cosmetics • Cylinder Kit

Cosmetic Accessories

byko-drive
Cat. No. 2121

Wire-wound rods
Cat. No. 2410

Multiple Clearance Square Applicator
Cat. No. 5361

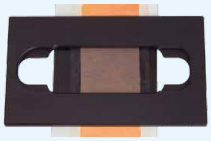
byko-charts
Cat. No. 2812

Sample Holder Round Dish – C
for spectro2guide
Cat. No. 6468

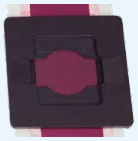
Sample Holder Round Dish – G
for micro-gloss
Cat. No. 4453

Sample Holder Round Dish – M
for BYK-mac i
Cat. No. 6415

Wet Drawdown Template – C
for spectro2guide
Cat. No. 6467



Wet Drawdown Template – G
for micro-gloss
Cat. No. 4439



Wet Drawdown Template – M
for BYK-mac i
Cat. No. 6440

Sample Holder Liquid Paste – M
for BYK-mac i
Cat. No. 6439

Sample Holder Cosmetics
Cat. No. 6469

Lipstick Kit
Cat. No. 6461

Nail Kit
Cat. No. 6462

Cylinder Kit
Cat. No. 6464

For more information please visit our "Cosmetic Market" at **www.byk.com**

BYK-Gardner Cosmetic Solutions

BYK-Gardner Objective Eyes

BYK-mac i

Multi-Angle Color and Effect Control.

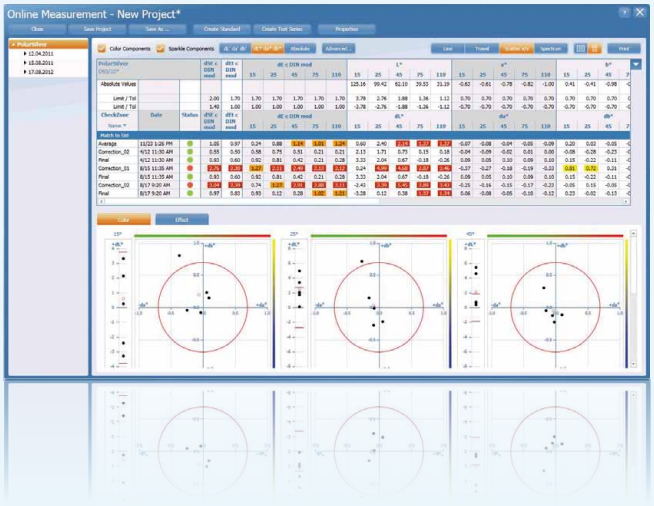
12 mm - Cat. No. 7034 | 23 mm - Cat. No. 7030

spectro2guide

The revolution in portable color control.

Cat. No. 7070 spectro2guide, d/8 | Cat. No. 7075 spectro2guide, 45/0

BYK-Gardner Software



smart-lab

Online Measurement. Instant Data Analysis.

Cat. No. 4862

haze-gard i

The Objective Standard for a Clear View.

Cat. No. 4775

micro-gloss

The New Intelligence in Gloss Measurement.

Cat. No. 4446

BYK-Gardner Light Booth

byko-spectra *effect*

Visual Evaluation
of Effect Finishes.

Cat. No. 6027

byko-spectra *pro*

Light booth for standardized visual color appraisal.

Cat. No. 6072 byko-spectra *pro* 115 V I Cat. No. 6073 byko-spectra *pro* 230 V

For a live demo please view our videos on **www.byk.com**

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