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Metallic and Pearlescent Pigments Accentuate Packaging Design

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Brilliant Looks

Metallic and Pearlescent Pigments Accentuate Packaging Design

The effectiveness of effect pigments in packaging is often underrated. If well targeted, they have sustained effect on consumer decisions. Brand name companies profit from this at the point of sale.

When most people hear the keyword 'color', it is probably their own favorite color that occurs to them. The next thing that comes to mind is clothing and fashion. Lifestyle undergoes constant changes and is subject to changes in color perception. Even furniture and kitchen cabinetry follow these developments that ultimately involve consumer goods. From large items, e.g., automobiles, to small ones, such as cosmetic jars or other packaging, everything is oriented to that particular trend. This leads to the question as to who actually sets fashion and color trends – is it the consumers via their buying behavior? Or do these perhaps generate those first? Or is it the companies that supply particular colors according to trends dictated by designers within a certain time frame?

This question arises not least in regard to packaging. Here, too, changing times are evident. Whereas packaging is mainly used to serve the purpose of protecting contents from external influences, or for keeping them fresh longer, nowadays they are multifunctional. In addition to their original tasks, they also serve as "silent salesmen", as speechless, but remarkably effective ones. Nowadays, packaging has become a main component of brand identity. It plays an important role in influencing consumer buying decisions.

Packaging is the means of communication that gives brand names a personal identity. It is the sole means by which a brand makes contact with the consumer. Research has shown that some two-thirds of all consumers make their buying decision on the basis of the packaging, whereby design is often the deciding factor.

A carefully composed interplay of colors is of extreme importance in this context. If well targeted, colors can, for example, magnify specific consumer emotions. That makes them more than a design tool – they serve to communicate. Seeing, feeling, desiring – packaging is supposed to awaken this need in the consumer – not the least with the aid of colors.

Future Value

There are lots of colors. Depending on the region and its culture, they give rise to different associations. The emotions they trigger in consumers differ correspondingly. This is all widely known, well researched and applied correspondingly.

Notably less attention, however, is paid to the potential that lies in the use of effect pigments. They can markedly expand any colored space by creating accents and nuances.

Gold, bronze or silver: effect pigments in pellet form are best suited for processing in plastics (figures: Eckart)

That way they access interesting new potential for packaging design.

These considerations lead to the question how brand name companies and designers can utilize the potential of innovative effect pigments in packaging in order to stimulate the consumers' senses, appeal to their emotions and ultimately motivate them to buy. This especially requires the interpretation of current color trends which – triggered by rapid changes in the fashion world – affect many consumer goods. Brand name companies that implement these trends quickly and efficiently in attractive plastic packaging utilize an important differentiating power, in short: they are a step ahead.

New colors are an economical alternative for a new brand and/or product look – without changing the packaging or even the content. This has immediate effect at the point of sale.

In order to make optimum use of the possibilities and color potential of effects, the special features of effect pigments are introduced in the following.

Three Types of Pigments

In general, we distinguish among three types of pigments: absorption pigments, metallic and pearlescent pigments.

Absorption pigments are inorganic or organic color pigments that absorb particular wavelengths of incident light and reflect the rest of the spectrum. Due to its shape and light absorption, they show only one color tone in all directions of view. They do not induce specific luster.

Metallic and pearlescent pigments together form the group of effect pigments. They are characterized by the fact that they change their brightness and color impression with the viewing angle. The optical effect results not from the absorption of particular wavelengths, but by reflection and/or interference. Depending on the viewing angle and illumination, effect pigments exhibit a subtle play of colors.

Metallic Effect Pigments Play with Light

Metallic effect pigments consist of tiny metal particles. Their characteristic feature is a metallic luster that creates mirror or chrome effects and enables an intensive interplay of brightness and darkness. These visual impressions are summarized by the term "metallic brilliance".

The fascinating metallic effect perceived by the human eye when viewing applications with metallic effect pigments is a combination of directional light reflection and scattering: incident light is reflected by the pigment surfaces and simultaneously scattered by the pigment edges and/or by uneven surfaces. Metallic effect pigments are brilliant whenever they reflect light radiation to a high degree and when little scattering and/or absorption of light takes place.

These properties – also the travel from bright to dark when the viewing angle is shifted away from the "gloss" or luster angle – make metallic effect pigments so unique. This so-called flip-flop is their most remarkable optical feature. The light reflection itself depends on the size and shape of the particles, as well as on their surface morphology.

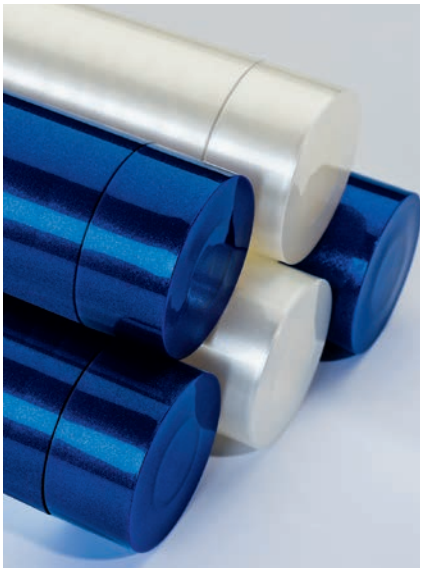

Fig. 1. Thanks to their special depth of color, pearlescent pigments are remarkably versatile

The brilliance of metallic effect pigments increases with particle coarseness and the perfection of the pigment surfaces, as well as with a narrower particle size distribution. When the pigments are very fine and unevenly shaped, the color shade shifts toward gray, which is often perceived as "dirty gray".

Very fine, bright pigments with high-grade metallic brilliance present the effect pigment industry with constant challenges. There are various ways to dealing with them. Polishing the pigmented surfaces can enhance metallic appearance. Defined and narrow-cut particle size distribution is also a way of achieving high-grade brilliance. This can be accomplished by screening and sifting the raw materials and classifying or sieving the pigments. Scattering effects at edges can be minimized by "silver-dollar"-shaped pigment particles. This circular particle geometry exhibits an optimum ratio between large surface (reflection) and small circumference or short edge length (scattering).

Fig. 2. Compared to conventional pearlescent pigments, Luxan pigments generate a unique sparkle (left); thanks to innovative technology, Luxan pigments create an especially "profound" twinkle

Fig. 3. Black isn't always black: with "colorful" Luxan pigments, various shades of color ranging from green (left) to red (center) or blue (right) can be created in dark plastics

Fig. 4. Transparency in various facets with glass-based effect pigments: Platalux pigments create a translucent glitter appearance (left) and Luxan pigments create brilliant effects (center). For comparison: a plastic without effect pigments (right)

Metallic effect pigments with coarse particles whose average size is larger than 25 µm are termed sparkle or glitter types. Under incident light, the human eye can perceive and resolve individual pigments of this size. Fine pigments with low average particle sizes (15 µm), on the other hand, offer excellent opacity.

Metallic effect pigments are generally manufactured from aluminum or copper-zinc alloys. Brass-based metallic effect pigments are usually called gold bronze pigments due to their golden look. By so-called fire coloring, the variety of copper and brass color shades can be expanded further.

Pearlescent Pigments Create Lustrous Colors

Pearlescent pigments give remarkable color effects that impress by means of light refraction and high reflective capability. That is why they are often called luster pigments. Nature served as the model for their development. They imitate the shimmering effect and soft luster that appears on the surface of a pearl or mother-of-pearl.

Filigree plate-like particles or flakes form the basis for these pigments, e.g. natural mica, which is coated with high refractive metal oxides, such as titanium oxide or iron oxide. Incident white light is reflected on the top and bottom interface (or upper and lower interface) in a way that amplifies or extinguishes the reflected light rays. Selective reflection of light, so-called interference, is the phenomenon involved.

The color of the pearlescent pigments depends on the thickness of their metal oxide coating. Interference colors are distinctly visible only in a specific angle – the luster angle. This effect also depends on which combinations of other color pigments are used. Finer effect pigment flakes create a silky and shimmering gloss with good opacity; coarser pigments provide a marked glitter and twinkle effect together with strong brilliance.

Pearlescent pigments based on synthetic mica substrates exhibit the greatest depth of color and exhibit an intense luster effect. They exceed their archetype, pigments based on natural mica. This is especially true of the pearlescent pigments developed by Eckart GmbH of Hartenstein, Germany. Their luster and color intensity are based on a special coating technology. Thus these pigments are suitable not only for silky nacre shades, but are also outstanding for intensive full tones, as shown in **Figure 1**.

Glass-Based Pigments: Brillance from Depth

Spectacular and extravagant color together with brilliant luster effects can be achieved by using extremely uniform and flat substrates, such as glass. These uniform and smooth flakes are coated with high-refractive metal oxides, thus reflecting light in exceptionally pure interference colors.

In addition to their narrow particle size distribution, their distinctiveness is based on their surface quality, by which we mean the homogeneity and uniform substrate thickness of this class of pigments. The exceptional transparency of glass-based effect pigments accesses enormous potential for brand name companies and designers in terms of packaging styling. As in a cut diamond, these pigments create 3-dimensional light reflection together with brightness and brilliance. These effects are the strongest on curved objects with sharp contours. Even under soft light, these pigments develop an attractive color gradient. In transparent plastics, the impression arises that their brilliance

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Fig. 5. Steel or metal optics are suited for flexible, high-value plastics

comes from the depth. Due to the high chroma or color strength of this class of products, the sparkle effect can be achieved even at a low pigment level (**Fig. 2**).

New Nuances of Black

Strictly speaking, black is not a color, but it plays an ever more important role in color matching and design. For one thing, it can be combined with almost all other colors. By itself, black is regarded nowadays as timeless, classic and noble, quite simply as stylish.

Glass-based luster pigments with their glittering and sparkling color facets access a wealth of new color nuances for black plastic packaging. On packaging for cosmetics and personal care products, this effect can develop particularly well. It emphasizes the special character of the product.

On the one hand, an extremely intensive and brilliant glitter results from the mirror-smooth surfaces of the glass substrates used. On the other, the dark color reduces the portion of reflected or scattered light. The result is unusual new color tones combined with interesting sparkle effects (**Fig. 3**).

Where a dark or black base color, or a background (e.g. co-extrusion) is involved, most of the transmitted light is largely or even entirely absorbed. The visible color is then mainly determined by the angle-dependent reflection of the glass-based effect pigments. Then a spectacular "black-color flip-flop" can be realized, and the actual border between black and color becomes blurred.

Tailor-made glass-based pigments, even in small quantities, enable extravagant effects on the finish of plastic products, thereby offering unique design possibilities. Among these are, for example, Eckart's Luxan products. These nearly colorless pigments create an especially impressive glitter effect on a dark background. These effects can also be created in opaquely dyed plastics, thereby expanding their potential for unusual styling considerably.

Transparency for Glass-Clear Elegance

Transparent packaging is becoming more and more popular. This new trend combines two different needs: on the one hand, the customer's wish to look at the product immediately; on the other, the industry's claim that its packaging is hygienically clean and safe for transport. If the transparent packaging is also colored, it likewise reminds one of precious stones, thereby giving an impression of elegance.

The new generation of effect pigments has interesting options to offer for these applications. In colorless, transparent plastic, they generate a strong, deep gleam – thanks to their own weak coloring paired with a rich interference color. Despite "missing" color, there is no need to do without valuable glitter effects. By using transparent plastic elements, the product and its packaging can quasi merge with one another, especially when they are color-tuned to one another. Generally speaking, the more transparent the plastic, the more brilliant the effect; this applies both to luster pigments, as well as to metallic effect pigments (**Fig. 4**).

Semi-transparent pearlescent or interference pigments, on the other hand, influence the transparency and inherent color of colored plastic parts. Thus they are ideal for translucent applications and can be combined with various plain colors.

Metallic Magic

Why is it that gold and silver, in fact, all metals fascinate us? Looking into the history books, we find that rare and, therefore, precious metals were reserved for rulers – emperors, kings and princes. Up until today, we continue to associate exclusivity and luxury with these colors.

If one wishes to transfer the unique appearance of metals to non-metallic materials, specially tailored metallic effect pigments are required. Especially suitable for this are high-grade aluminum-based metallic effect pigments. The so-called silver-dollar types are particularly suited for such applications, since they combine strong brilliance with good processing stability in plastics. They can be utilized in plastics to produce appearance comparable to those of silver-metallic paints in the automotive field, for example.

Metal-look design needs no embellishing. Instead, it relies on objectivity and clarity to convince buyers. It also appeals to technologically interested buyers. Metallic-looking surfaces give the impression of high value and access new markets for the plastics industry in the automotive field, in household goods and in consumer goods, in general.

Fig. 6. Symic pigments combine pearlescent effects with warm earth-tones

Fig. 7. With their striking sparkle, Platalux pigments lend an etraordinary brilliance even to everyday products

The metallic effect stands out best only if the plate-like pigments are wetted and dispersed optimally and ideally oriented parallel to the surface. That is why expensive-looking plastic surfaces with metallic appearance are particularly sophisticated applications (**Fig. 5**). Only the brightest pigments are suitable for obtaining metal or steel-like apperance. For example, fine aluminum pigments with silver-dollar geometry have this excellent optical property, that looks just like real metal or steel surfaces.

Special products combine the properties of pearlescent pigments with the metal optics and flip-flop of metallic effect pigments. These new effect pigments (Symic Opaque Silver) give decorative applications a look that is velvety and glitters at the same time. They can be used to imitate patina silver surfaces or the optics of anodized aluminum.

Colored Metallics

For a tinted metal look, only transparent color pigments and dyes are recommended. Most organic pigments fulfill this requirement. The use of strongly opaque color pigments should be avoided as far as possible, since any light-scattering effect tends to impair the typical brilliance of metallics and can even make it disappear.

Silver and chrome effects will continue to have exciting potential for expensive-looking articles in plastics. This is apparent in, among other applications, the automotive field where more and more mass-colored parts with metal optics are being used, e. g., for door handles or trim parts.

From Bronze to Copper and Red

In order to realize a cozy interior room atmosphere, metallic effects in warm colors are required. The brilliant look of precious metals, such as gold or copper, can be realized by gold bronze pigments. They cover a wide range of various gold nuances and copper tones. Higher processing temperatures may require coated gold bronze pigments. Due to copper oxidation in gold bronzes, the color tone can shift toward darker and matter ones. As is common with metallic effect pigments, the coarser the pigment, the brighter the colors and the stronger the sparkle effect. Finer pigments have higher opacity with a darker color impression.

Warm, pure color tones can be realized with pearlescent pigments (**Fig. 6**). If iron oxide is used instead of titanium oxide to coat interference pigments, the result is strong tones of bronze and copper color, or even intense tones of red. These earthtones are particularly strong due to self-absorption of the iron oxide.

Patina surfaces make a high-value impression that is extremely interesting for interior design. From a color-technical point of view, they have reduced brilliance and often non-uniform shades of color. Such matte effects can be achieved by small additions of opaque color pigments, since they reduce brilliance by scattering light.

Luxury and Glamor

Rich colors and – depending upon the application – extravagant brilliance or sparkle give the product a high-value look and underline its quality. Exclusiveness is expressed even in our times by colors and special effects. Such effects are created by Eckart's Platalux pigments. Their silver-metallic glitter effects exhibit rich and strong colors in a new light. These pigments consist of silver-coated glass. Due to their extraordinary sparkle effect – combined with a basic champagne-colored shade – they can be used to achieve intense glitter effects in the full tone or in combination with transparent color pigments and/or dyes (**Fig. 7**).

Conclusion

Brilliant looks make things desirable. That goes for consumer products, as well. Yet the enormous potential that effect pigments offer for the design of plastics packaging is still far from being fully realized. Individual color nuances access brilliant possibilities for a design that emphasizes product character while being tailored to the taste of the target group. Which pigment in which quality and in which dosing is the right one – that is something that brand name manufacturers can best clarify together with pigment manufacturers. Most of the time, the most fruitful ideas arise during intensive cooperation along the value chain. ■

