Chapter 10

Specialty Pigments

This chapter will focus on specialty pigments. The pigments in this category tend not to be used in large volumes, because of regulatory restrictions, handling and compatibility issues, and cost, or due to the fact that their effect is only needed in certain instances. Despite this limited used, these pigments bring spectacular, unique effects to the products in which they are incorporated, and are therefore an extremely important class of color additives for the decorative cosmetic industry.

Metallic Pigments

Chapter 8 covered a class of effect pigments referred to as metallics, which in composition are iron oxide and/or titanium dioxide coated natural and synthetic micas. The metallic pigments covered here are truly metallic—essentially the pure metals aluminum, copper and bronze, as represented in the **color insert** as **Figure 10.1** (bronze and copper) and **Figure 10.2** (aluminiums). Their mechanism of color display is different from both the absorption and effect pigments. The absorption colors operate by selectively absorbing and diffusely reflecting different wavelengths of light as shown in **Figure 10.3**. The circles represent particles of pigment

on the surface of the skin. The long arrows show incident light striking the surface of the pigment and being reflected at diffuse angles. Finally, the short arrows penetrating into the pigment demonstrate light being absorbed.

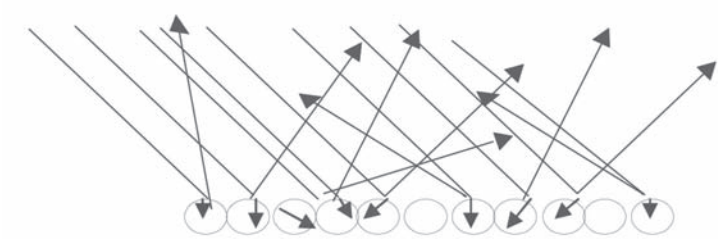


Figure 10.3 Absorption Pigment Color Mechanism (Image provided courtesy of Eckart)

Effect pigments operate by selectively absorbing, reflecting, refracting, and transmitting light, as is shown in **Figure 10.4**. The arrows in this figure show incident light being reflected at both the specular and diffuse angles and being transmitted through the crystal.

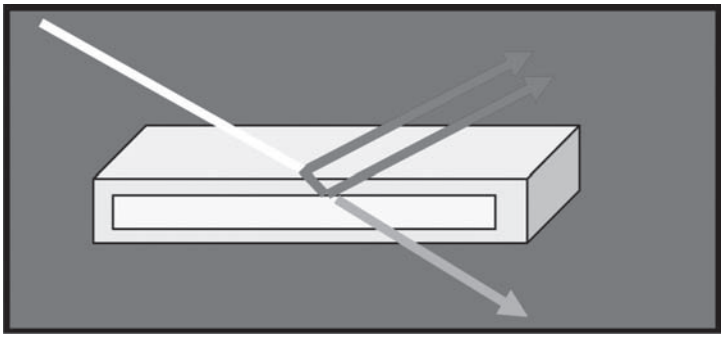


Figure 10.4 Effect Pigment Color Mechanism (Image provided courtesy of Eckart)

The metallic pigments produce their color effects by reflecting the entire wavelength range of incident light with a very high degree of it at the specular angle, producing a bright metallic look as would be seen in jewelry. **Figure 10.5** demonstrates this mechanism, where the flat, platelike particles are the metallic pigment and the arrows are incoming reflected light, most of which is at the specular angle.

The appearance of metallic pigments, like that of effect pigments, is controlled by several factors, including particle size, shape, distribution, and

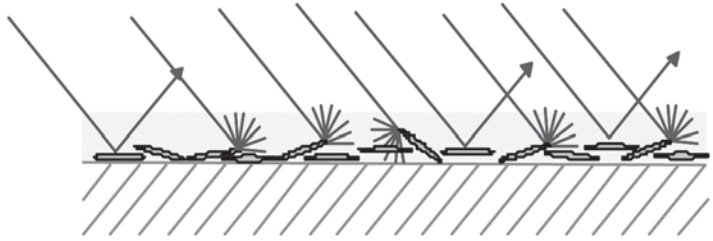


Figure 10.5 Metallic Pigment Mechanism (Courtesy of Eckart)

orientation. Of these factors, the influence of particle size is dominant, impacting the metallic character and the optical properties. With respect to the former, coarser particles have a high surface-to-edge ratio, which produces fewer scattering centers, resulting in a higher degree of specular reflection. This gives these pigments a more brilliant metallic character. Finer particle pigments have a lower surface-to-edge ratio, which results in more scattering centers and therefore a higher degree of diffuse reflection, which yields more of a soft, less brilliant metallic character. Brightness of the metallic pigments increases as their particle size increases, while the coverage is the reverse; it decreases as the particle size increases.

The general particle size ranges are as follows:

Fine Grade: 5–50 microns. Brilliant effect with excellent coverage.

Medium Grade: 15–70 microns. Bright effect with good coverage.

Large Grade: 20–95 microns. Sparkle effect with fair coverage.

Aluminium Pigments

Traditionally, aluminium pigments were manufactured by processing aluminium particles through a ball mill in the presence of a solvent,

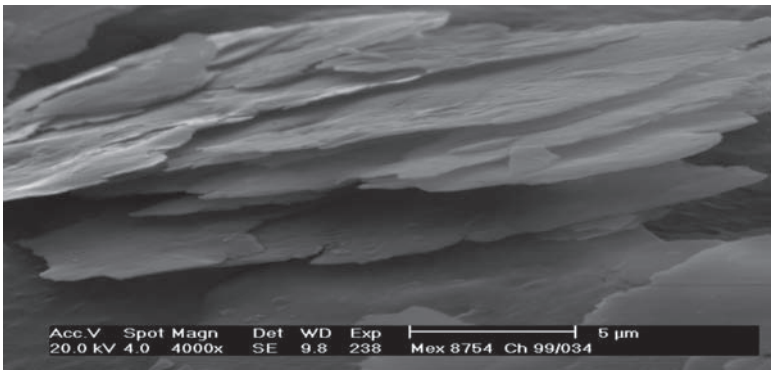
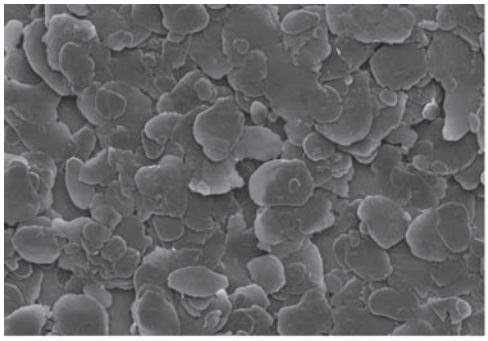


Figure 10.6 Conventional Cornflake Pigments (Image courtesy of Eckart)

followed by classification through a sieve, then solvent removal by means of a filter press, to be then finally processed into dry and/or dispersion forms. This production technique produces particles that are best described as a cornflake structure and are shown as an electron photomicrograph in **Figure 10.6**. These particles have edges that measure in the 100–500 nanometer range.

More recently, a novel process for the manufacture of aluminium pigments has been developed, by which aluminium is vaporized and deposited onto a polyester film. The aluminium pigment is then stripped from the film, classified, and processed into dry and/or dispersion forms. The particle produced by this method has edges that measure in the 30–50 nanometer range.



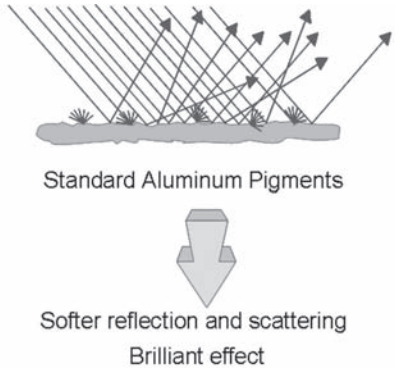
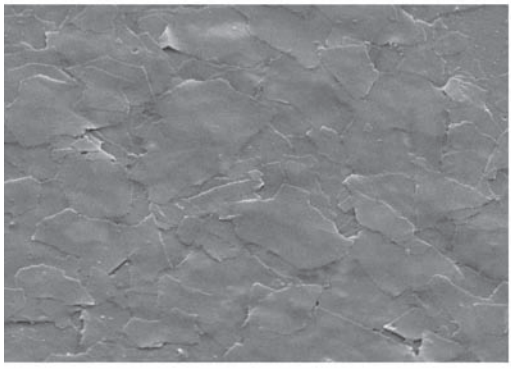


Figure 10.7 Conventional Cornflake Pigment
(Image courtesy of Eckart)



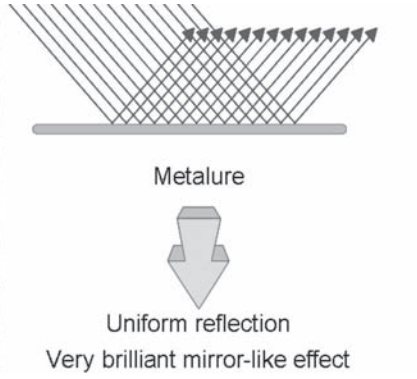


Figure 10.8 Vapor Deposition Pigments
(Image courtesy of Eckart)

The difference in the edges between the two products makes a dramatic difference in the effect they produce. The conventional cornflake product

edges cause more light scattering than those of the vapor deposition product, which results in more diffuse reflection, and therefore a more satin metallic effect. The vapor deposition product produces an almost mirrorlike reflection effect. **Figures 10.7** and **10.8** show, in electron photomicrographs, the difference between the two types, respectively, making it readily evident how much thinner the vapor deposition pigments are.

The latest generation of metallic aluminium pigments is a series where a layer of aluminium hydroxide alone is deposited on the surface of the aluminium, or a layer of an absorption pigment and a layer of silica are deposited together. These pigments are represented in **Figures 10.9** and **Figure 10.10**, respectively. The combination of the two materials results in pigments with the brilliance of aluminium and the added effect of vivid color from the absorption pigment. The absorption pigments used are typically ferric ammonium ferrocyanide, D&C Red 7 Ca Lake, and D&C Red 34 Ca Lake. The aluminum hydroxide imparts a champagne color to the aluminium, while the two reds bring a bright red and a bright violet to the effect party.

Figure 10.9 Aluminium Hydroxide-coated Aluminum (courtesy of Eckart)

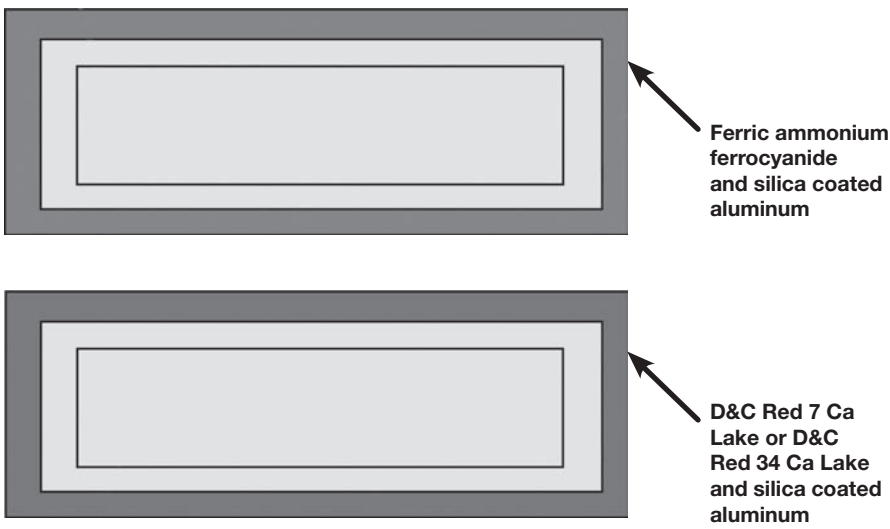


Figure 10.10 Absorption Pigment/Silica Coated Aluminium (courtesy of Eckart)