Automotive Industry:
Color Control and Management

Introduction

Today's consumers are discerning and demanding. Bedsides the functions of a car, attributes such as brand, design and color are important factors influencing their purchase decision.

Consumer associate color with brand. When we talk about Ferrari, the first thing that comes to our mind is a burning red performance car. For Lamborghini, the mind shouts a distinct orange. Mercedes is associated with a classy silver while BMW, the classic white. Apart from brand, color is also closely associated with design. A burning red sporty design is perceived as dynamic and slick while a sliver classic speaks of luxury, elegance and class.

Many automotive manufacturers employ strict standards to ensure that every vehicle roll off the line has the right color consistently. Effort is put into the quality control process to ensure no color mismatch between the body, bumper, fenders and side mirrors. Car interior parts are checked to ensure colors of dashboard, seats, compartments and carpets blend well in the cabin. To ensure consistency, predictability and dependability, color management and control is the key.

Color Management and Control

As a manufacturer or supplier, getting the color and trim right to meet consumer demand is vital. From coating, plastic, composite, rubber, fabric and leather to color contrast, texture and pattern, every colored component must meet exact specifications before a vehicle rolls out.

Stringent color matching standards are established for every colored components in a car. With color becoming more important, it becomes complex for both manufacturers and supplier. Manufacturer need to manage a growing range of models and huge pool of suppliers.

For suppliers, they have to match and provide the exact specifications as defined by the manufacturers. Synchronization among manufacturers, subsidiaries and supply chain ensures no color misfits will occur.

Coating

The process of qualifying car parts us tedious. Parts are supplied through a channel of vendors and each of them has their own color formulation and suppliers. During incoming inspection, color difference are not distinguishable, but becomes prominent once the parts are assembled. Color mismatch leads to rework and is costly, especially in a production line that is highly automated.

While visual inspection is necessary, it may not meet quality control standards with demands on exact color matching for all parts. Engineers are shifting away from visual color inspection and adopting numerical color inspection system to ensure consistency in shade.

In numerical color inspection system, color measuring instrument is used to provide color values to control color. With color measuring instrument, engineers can quantify color using the CIE L*a*b color space. Color tolerance can also be easily established by engineers using the ΔE*ab
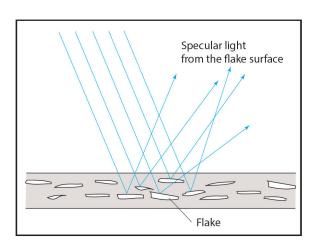
Automotive Industry:
Color Control and Management

color difference formula for all their suppliers and subsidiaries to comply.

Metallic coating

[Metallic coating](#) causes color to look different when viewed from different angles. This happens because metallic coating formulations contain metallic flake pigment that interfere and causes light to reflect in different directions. To fully evaluate and capture the color travel, color measuring instrument with multiple viewing angles is necessary.

Specular light from the flake surface

Flake

Gloss

Surface texture alters the appearance of color. A glossy coat makes a color look darker in shade, while a matt surface looks lighter. A highly glossy finish with smooth and homogenous surface us what most consumers look for in a car. To meet these expectations, coatings must be free from orange peel or haze.

[Orange peel](#) is an effect that reduces the appearance quality without affecting gloss readings. As the name suggests, orange peel resembles the skin of an orange. Haze is a milky finish with a loss of reflected contrast. Halos and patterns can be seen around the reflections of high intensity light sources.

To quantify gloss, orange peel and haze, a 3 angle gloss meter with parameters like RSPEC, haze, [distinctness of image (DOI) and reflected image quality (RIQ)](#) is necessary.

Interior Color

As the whole driving experience is embedded in the cabin, the interior design and color os a car is very central to the consumer's perception and is one of the main differentiating criteria in their purchase decision. To ensure a harmonious interior, the design and color of the dashboard, seats, steering wheel, cabin and even the flooring needs to be coordinated.

Controlling interior color of a cabin is a hard task as they are assembled using different materials that comes
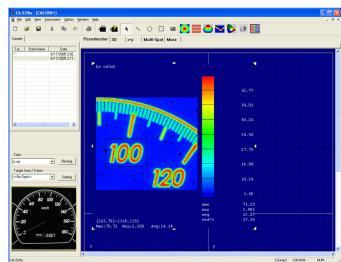
Automotive Industry:
Color Control and Management

in different textures and from many suppliers. It is important to establish tight color tolerances to ensure consistency. Because of these tight tolerances, visual assessment alone is difficult and insufficient. Color measuring instrument with good repeatability performance is necessary to control the color objectively.

Light and Display

Apart from exterior and interior color, lighting and display systems of a car adds to the design and safety. Externally, the headlight, tail light and indicator signal must be tested to ensure they comply with the necessary regulatory standards and can be seen by other drivers.

Within the cabin, the brightness and color of the dashboard display are checked and adjusted to the right levels for comfort and safety. Similarly, cabin lighting, internal indicator signal and in-car infotainment display system (touch screen, GPS, video, radio and etc) needs to be coordinated to achieve interior light harmony.

Advancement in display technology sees the rapid evolution of augmented reality head-up display that projects infotainment and enhance navigation information onto the windshield. Measuring of luminance and chromaticity in both night and day time is necessary to ensure consistent legibility.

Some of the common light and display performance parameters are luminous intensity distribution, luminance uniformity, contrast ratio, chromaticity coordinates (color gamut), grey scale (gamma), grey scale color changes (white balance).

Konica Minolta offers a wide range of light and color measurement instrumentation and solutions to meet the diverse requirements of the automotive industry.

Learn more about the basic of color and light principles and terminologies with our educational booklets. Alternatively, you can call us at (+65) 6563 5533 or contact us through here for a free consultation with our light and color specialist.