Guidelines for viewing cabinets for sparkle and graininess sample evaluation

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Created during the research project „xD-Reflect: Multidimensional Reflectometry for Industry"

Special-effect pigments provide a change in color with viewing and illumination direction. Besides this angular dependence on viewing/illumination direction, metallic finishes also exhibit a visually complex texture. Depending on the properties of the finish and the viewing and illumination conditions, the flakes exhibit a sparkle like texture [1].

Nowadays, there is only an instrument on the market to measure the effects of texture, the multi-angle spectrophotometer BYK-mac. In particular, to measure the sparkle effect, the sample is illuminated directionally under 15º, 45º and 75º counted to the normal on the sample surface, and in order to measure the graininess effect the sample is diffusely illuminated by means of an integrating sphere. The photographed gray-scale pictures are internally used to calculate texture parameters. Three parameters are obtained for characterizing the sparkle: sparkle intensity (Si), sparkle area (Sa) and sparkle grade (S_G) for the three directional geometries. The total size of the small and bright areas per unit area is called sparkle area. The sparkle intensity is specified as the intensity of the small and bright light spots in relation to the intensity of the less bright surrounding. The sparkle area and the sparkle intensity are combined in the representative sparkle attribute called sparkle grade. For the diffuse illumination, a parameter (G) is calculated to characterize the graininess effect. For this reason, the byko-spectra effect (BSE) by BYK-Gardner was designed to evaluate sparkle and graininess texture following the design of this instrument.

On the other hand, in many industrial applications where color matching and visual approval is related to solid or homogenous colors it is usual to work with diffuse lighting booths [2-4]. In the automotive sector, and in special for interior trim, or for visual assessments of curved components based on solid pigments, the most used lighting booths with diffuse illumination (Figure 1) are:

- X-Rite SpectraLight III (now replaced by SpectraLight QC Light Booth): http://www.xrite.com/spectralight-iii ;
- Verivide CAC 150-5: http://www.verivide.com/start/en/products/light-cabinets/cac-150-5

This type of lighting booth usually have a list of fluorescent and incandescent lamps for simulating with different grades of colorimetric performance some CIE standard illuminants as D65, A, F11, etc.

Figure 1. Commercial diffuse lighting booths using for color evaluation: X-Rite SpectraLight III (left) and Verivide CAC-150-5 (right).

However, for gonio-apparent panels, trying to perceive all their color travel, or lightness and color flops, or even texture, it is recommended to use a directional lighting booth, and preferably with an opto-mechanical design for the viewing area or plane following the guidelines of some international standards. In this case, the best example of commercial directional lighting booth is the byko-spectra effect (BSE) by BYK-Gardner (Figure 2). Moreover, this new lighting booth also has additional luminaires for visual evaluation of sparkle for the three recommended geometries.

Other interesting lighting booth for gonio-apparent colors, but not useful for color discrimination and its visual tolerances, is the gonio-vision-box (http://www.goniovision.com/ , GVB), which partially enables to percept the color gamut of gonio-apparent panels for the most of multi-angle spectrophotometers.

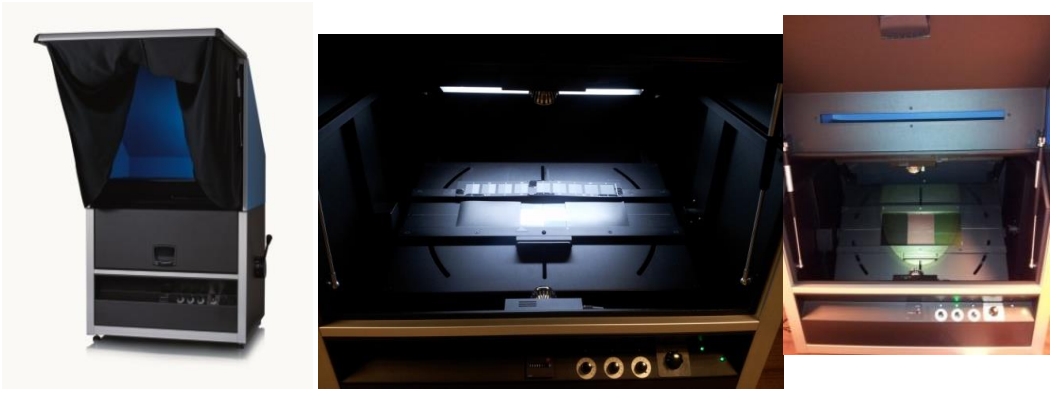

Figure 2. Commercial directional lighting booth using for color evaluation of gonio-apparent colors: byko-spectra effect with some pictures of its interior (center: for color evaluation; right: for sparkle evaluation at 45º geometry).

Taking into account, the needs for sparkle and graininess evaluation from our experience with visual experiments, the main issues to consider for a good viewing cabinet would be:

- Key technical issue for the correct visual (perceptual) and instrumental correlation: uniform illuminance level (color pair), whatever the background type and measurement and observation geometry, and its type: diffuse or directional (45as, 15as, etc);
- Illumination: Diffuse illumination interchangeable with directional illumination
    - ***Graininess***: Diffuse illumination: easier for controlling, as well as for horizontal and vertical planes, with longer height of luminous exposure;
    - ***Sparkle***: Directional illumination: necessary and more intense for correctly evaluating sparkle/glitter, even in some illumination planes. Different measurement geometries with specific positions for visual assessment at 90 deg. Preferrable to choose the same direction of instrument for characterization
- New materials for light sources: white LEDs.
    - Valid for D65 simulation with high quality
    - More energetically efficient, stationary, and very small;
    - Flexible and lighter luminaires in vertical stripes (D65, TL84, etc);
    - Possibility of color filtering for D65 and TL84 simulation;
    - New possibilities with spectral color filtering with new plastic materials specifically formulated
- Sufficient space for isolated 3D components

References

[1] Pfaff, G.: *Special Effect Pigments*, 2nd ed. Norwich: William Andrew Publishers (2008).

[2] CIE 15:2004. *Colorimetry*. Vienna: International Commission on Illumination.

[3] ASTM D1729-09. *Standard Practice for Visual Appraisal of Colors and Color Differences of Difussely-Illuminated Opaque Materials*. Conshohocken: American Society for Testing Materials.

[4] ASTM D2616-03. *Standard test method for Evaluation of Visual Color Difference With a Gray Scale*. Conshohocken: American Society for Testing Materials.