

A poll was circulated via email to the newsletter mailing list on June 19th. Please respond to this poll if you have not already so that we can consider your input regarding CAD RETEC® planning. Thank you. You can also access the link by [clicking here](#).

CORONAVIRUS UPDATE

The current COVID-19 pandemic has touched everyone's lives and altered the way we interact and do business. As you know the CAD RETEC®, currently scheduled for late September 2020, is the largest and most valuable color conference for plastics providing a great opportunity for color education and networking. The CAD RETEC® committee is monitoring the situation and working with the venue to build solutions for social distancing so that we can provide the excellent technical content and knowledge transfer you've come to expect.

We will post periodic status updates for CAD RETEC® 2020 on the website and through social media.



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Election Results

Color & Appearance Board of Directors

for term beginning July 1st, 2020 and ending June 30th 2023

Breeze Briggs
Matthew Billiter
Steve Esker
Karen Carlson
Daniel M. Martelli
TJ Stubbs
Jeffrey Drusda
Andrew E. Smith
Tony Tanner

Congratulations and welcome aboard to our new directors!

Annual SPE CAD Survey Raffle

We are looking for gifts to use for the SPE CAD Survey Raffle that will be given away at the end of the conference proceedings.

If you have a prize of \$25 or more and want to supply for the raffle, please contact:

Chuck DePew or +1 765-914-3363

Editor's Note



Welcome to the Summer Issue of CAD NEWS®.

This issue highlights the upcoming CAD RETEC® taking place in Orlando, FL in September.

Thanks to all who have already responded to our CAD RETEC® 2020 poll. We are leaving the poll open until June 30th for those who have not had time to respond as of yet.

As always, please look through the sponsorship ads in this issue of the CADNEWS®. A click on the sponsorships will take you to the respective website allowing you the opportunity to learn as much as you can about the industry you are part of, the Color and Appearance of plastics.

Mark Tyler
Newsletter Editor
tylerm@xxsilberline.com

Councilman's Report

March 27, 2020

Total assests at the end of 2019 was \$6,848,487 (2018 was \$5,956,673) with equity of \$3,442,381 (2018 was \$2,628,729). There were no predictions for where the Society is expected to be at the end of 2020 given the current uncertainties. Cost savings account for an increase in equity rather than bringing in more cash (or more members).

Much of the rest of the meeting was spent confirming the changes to the by-laws brought about by the change in governance (*simplified, the EB to govern rather than Council*).

A VP of Sustainability will be established to replace the VP of Marketing and Communications (Conor Carlin). Nominations for the position are open until April 16th. All other VP position nominations are closed.

A new free-to-access Plastics Journal was to be announced at ANTEC®. More information to follow.

ANTEC® this year will be an on-line event. They are asking that members help promote the event to their employers/employees/colleagues.

Council Committee of the Whole met to discuss concurrent on-line access to live conferences (for when we are able to have such things again). Comments were positive but no follow-up actions were identified. There was also talk about promoting the benefits of plastics related to COVID-19 safety, how plastics are used in PPE and that municipalities have relaxed single-use plastic bans. Again, no follow-up actions were identified.

Mercedes Landazuri
Councilor, Color & Appearance Division

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The SPE Color and Appearance Division generously donated \$35,000 to PlastiVan® in 2019. Combined with their 2018 gift of \$17,500, their support over two years of \$52,500 provided a PlastiVan® visit to 30 classrooms, bringing the exciting world of plastics to thousands of students. Thank you, Color and Appearance Division, for this meaningful impact toward changing the perception of plastics one classroom at a time. And a big THANK YOU for committing to another \$35,000 for 2020!



PlastiVan®



PLASTIVAN®: CHANGING THE PERCEPTION OF PLASTICS ONE CLASSROOM AT A TIME

Through lively demonstrations and hands-on activities, the PlastiVan® Program is designed to excite students about opportunities in science and engineering within the plastics industry. Students are educated about the chemistry, history, processing, manufacturing, and sustainability of plastics and how the science and real-world applications relate to their everyday lives. PlastiVan® provides sound science and educational programs which spark scientific curiosity in students while increasing their knowledge of the contribution plastics make to modern life; encouraging them to seek careers in engineering.

PlastiVan® educators are skilled in tailoring the presentation to meet the needs and grade-level expectations of each classroom and teacher. The program is easily integrated into school curricula. A PlastiVan® visit typically consists of 5 classes/day for up to 40 students/class or is individually designed for STEM and science fairs.

[Click here](#) for more information on the PlastiVan®



Pre-registration online

Go to 2020 CAD RETEC® HOME

Preconference Tutorial Coloring of Plastics

Presented by Bruce Mulholland, Celenese, SPE Fellow

Sunday 20 September 8:00 AM – 4:30 PM

Fee: \$525 (Must Pre-register for event. Extra fee not included with CAD RETEC® 2020 registration)

Onsite Registration

Sunday 20 September	1:00 PM – 7:00 PM
Monday 21 September	7:30 AM – 5:00 PM
Tuesday 22 September	7:30 AM – 3:00 PM

CAD RETEC® 2020 Golf Outing

Sunday September 20th, 2020

Shingle Creek Golf Club

Registration and lunch 11:00 AM – 12:45 AM

Shotgun start at 1:00 pm

Price: \$ 100.00 per golfer

Includes: the range, green fees, cart fee, lunch, Awards (hole prizes), scramble format. For more details, visit the www.specad.org

CAD RETEC® 2020 Fun Run

Tuesday 22 September 2020

Sponsored by DCL



\$25 Registration fee

All proceeds go to Habitat for Humanity
SPE CAD will match every \$25 donation



SPE CAD RETEC® Coloring of Plastics Tutorial

The Color and Appearance Division of SPE has been presenting the “Coloring of Plastics” tutorial at the start of the CAD RETEC® conference for many years. Many SPE members and non-members have benefited from this program. The tutorial is a great starting point for those just beginning a career, or an excellent continuing improvement opportunity to those who wish to add to their base knowledge of coloring of plastics. The course is full of practical information which is embellished and enlightened by the active participation of all the attendees.

The tutorial runs a full day on Monday prior to CAD RETEC® and does require a separate registration and fee. The attendance is limited to 20 persons, so register soon. Attendees receive a full-color manual to use as a reference when they return home.

Who might benefit from attending the tutorial?

- ◆ Executives needing to better understand their company’s coloring issues
- ◆ Managers newly appointed and/or desiring to communicate more effectively with peers and subordinates
- ◆ Color formulators/matchers to better understand the theory behind their work
- ◆ Color specifiers/approvers to understand limitations in coloring of plastics
- ◆ Sales personnel hoping to gain more technical knowledge to better serve their customers
- ◆ Product designers wishing to better understand the technology behind the coloring of plastics, to make better and more informed decisions
- ◆ Color manufacturing personnel to understand the impact of compounding on color
- ◆ Color processors (injection molding, extrusion, etc) to better understand the technology ways they can impact the final color

Attendees will leave the course with a better understanding of color technology and should be more effective in their careers around color.

For more information about Color of Plastics Tutorial, please contact the Conference Chair and Tutorial Instructor Bruce Mulholland at bruce.mulholland@celanese.com or call 859-525-4765

To register for this opportunity please visit the [SPECAD Website](http://www.specad.org)



CAD RETEC®
Orlando, FL • September 20-22, 2020
Presented by SPE Color and Appearance Division



Preliminary Technical Program, Gold Room

Monday 21 September 2020

Time	Category	Speaker/Company	Title/Sponsor
7:00–8:00 AM	Breakfast		Sponsored by DCL
8:45 AM	Opening Remarks	Jeff Drudsa – Chemours	Welcome to CAD RETEC® 2020 in Orlando, FL
9:00 AM	Paper	Jeralyn Camp – BYK Gardner	How Gloss and Texture Affect Visual Color
9:30 AM	Paper	Patrick Ryan – Silberline	The Effect of Particle Size, Morphology, and Loading Levels, of Aluminum Pigments in Polypropylene Molded Products
10:00 AM	Break	Exhibits open (Exhibitors) Exhibit Hall	Sponsored by Clariant
10:30 AM	Paper	Eric Andrews – Colour Synthesis Solutions, LLC	Reconciling Risk Assessment of Colourants with Contemporary NIAS Strategy
11:00 AM	Paper	Scott Aumann – EMD Performance Materials	TBD
11:30 AM	Paper	Bruce Mulholland – Celanese	Design for Sustainability – A Case Study with Appearance Nylon
12:00–1:30 PM	Lunch		
1:30 PM	Paper	Breeze Briggs – BASF	Coloring Plastics for a Sustainable World
2:00 PM	Panel Discussion	Doreen Becker – Ampacet	Sustainability
3:00 PM	Break	Exhibit Area Exhibit Hall	Sponsored By Sun Chemical
3:30 PM	Paper	Bonnie Piro – Sudarshan	Property Manipulation of CIC (MMO) Pigments
4:00 PM	Paper	Nathan Noyes – Croda	Advances in Liquid Color Concentrate Formulation
5:00 PM	NTF	Scott Heitzman – Moderator	New Technology Forum

Network Reception

Monday 21 September 2020

Exhibitor Area, 6:00 pm – 7 pm, (Green tickets)

Sponsored by The Shepherd Color Company





CAD RETEC®
Orlando, FL • September 20-22, 2020
Presented by SPE Color and Appearance Division



Preliminary Technical Program, Gold Room Tuesday 22 September 2020

Time	Category	Speaker/Company	Title/Sponsor
7:00 AM	Activity	Fun Run/Walk Renaissance Lobby	Sponsored by DCL
8:15 AM	Opening Remarks	Jeff Drusda – Chemours	Welcome to Day 2 CAD RETEC® 2020 in Orlando, FL
8:30 AM	Paper	NASA	To be determined
9:30 AM	Paper	George Iannuzzi	Consumer Packaging Directions for 2020+
10:00 AM	Break	Exhibit Area Exhibit Hall	Sponsored by TBD
10:30 AM	Paper	Sal Monte – Kenrich Petrochemicals, Inc.	Functioning the Pigment Interface with 1.5–Nanometer Titanates and Zirconates
11:00 AM	Paper	Jackie Anim – Ethicon	Role of Branding and Color Science in Medical Devices
11:30 AM	Paper	Rob Lorenzini – Maroon Group, LLC	New Functional Inorganic Pigments for Laser Marking and Compostable Plastic Products
12:00 PM	Luncheon	Awards Luncheon Exhibit Hall	Sponsored by Tronox
1:30 PM	Paper	Curtis Ross – DLC	Increasing the Jetness of Pigment Black 7 Using Secondary Pigments
2:00 PM	Paper	Joseph Fay – BASF	The Effect of Accelerated Weathering Conditions on the Appearance of Polymer Compounds Intended for Outdoor Applications
2:30 PM	Paper	Mark Ryan – The Shepherd Color Company	Innovation in Unlikely Places: Hard Work, Attentiveness, and Luck Lead to New Pigment Chemistries
3:00 PM	Break	Exhibit Area Exhibit Hall	Sponsored by TBD
3:30 PM	Paper	Mike Willis – Sun Chemical	Colorants
4:00 PM	Paper	Pat Haugen – Sasol	Improved Dispersibility with Fischer Tropsch Synthetic Waxes in Manufacturing Masterbatch and Colorants
4:30 PM	Closing Remarks	Jeff Drusda – Chemours	Raffle (Prizes TBD) Must be present to win!!
5:00 PM			Conference Ends

SOCIETY OF PLASTICS ENGINEERS
2020 CAD RETEC® Golf Outing



Sunday September 20th, 2020

Shingle Creek Golf Club

Questions Contact:

Mark Tyler (570) 952.5255

Mark Freshwater (201) 665.0091

Alex Prosapio (845) 641-0506

[click here to register on line](#)

The future of your best golf game may just be waiting on the sandy banks of the historic Shingle Creek, where stories of the past burble mysteriously beneath the silken black waters. Shingle Creek is waiting for you to experience the natural beauty and joy of the game. Experience it for yourself - true Florida style golf in an historical, lush, natural setting. It's the course, it's the history of the Shingle Creek, and it's the experience. And we're giving you "fair way" warning. Once you experience golf the Shingle Creek way, you'll never be satisfied with ordinary golf again!

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Schedule (EST)

Registration & Lunch 11:00am to 12:45

1:00pm Shotgun Start

Course Location

9939 Universal Boulevard

Orlando, FL 32819

Phone: (866) 966-9933

Price

\$100 per Golfer

*Includes: Range,
Green & Cart Fees,
Lunch*

Awards (hole prizes)

Scramble format: Teams will be drawn based on handicap

When registering, after your name input typical 18 hole or 9 hole score. Please be honest to make this fair score.



MAKE A **SPLASH** WITH COLOR
CAD RETEC®2020

Conference Registration

September 20 – 22, 2020 • Renaissance Orlando Sea World Hotel
Orlando, Florida

(SELECT ONLY ONE TYPE OF REGISTRATION)

SPE MEMBER 2020

☐ Advance \$410

☐ Late / Onsite (After 8/21/20) \$510

SPE NON-MEMBER:

☐ Advance \$630

☐ Late/Onsite (After 8/21/20) \$730

OTHER REGISTRATION TYPES:

☐ Speakers \$190

☐ Student (w/ Valid Student ID): \$ 50

☐ Emeritus: \$100

☐ Tabletop advanced registration \$1,350

☐ Tabletop late reg (After 8/21/20) \$1,550

EXTRA CONFERENCE LITERATURE:

☐ Extra RETEC® 2020 \$115 x ____ = \$_____

☐ Archive DVD (1961-2007) \$175 x ____ = \$_____

(available on site)

OTHER EVENTS REGISTRATION/RSVP

☐ Golf Outing (Monday): \$100

☐ 5K Fun Walk (Wednesday): \$ 25

☐ "Coloring of Plastics" Tutorial (Monday): \$525

CAD RETEC® Committee:

Chairperson:

Jeff Drusda, The Chemours Company

jeffrey.drusda@chemours.com

Vice Chairperson:

Cheryl Treat, BASF

cheryl.treat@basf.com

Technical Program:

Alex Prosapio, Sudarshan

aprosapio@sudarshan.com

Mark Tyler, Silberline Manufacturing

tylerm@silberline.com

MAKE A **SPLASH** WITH COLOR
CAD RETEC®2020

**Attendee & Exhibitor
Registration link**

**Sponsorship
Registration link**

CALL FOR PAPERS

YOU ARE INVITED TO SUBMIT A PAPER FOR PUBLICATION & PRESENTATION

Podium and poster presentations showcasing the latest in industrial, national laboratory and academic work.
Share your findings in polymer research or new and improved products and technologies

TOPICS WILL INCLUDE

- | | | |
|---------------------------------------|-------------------------------------|--------------------------------|
| ◆ Additive Manufacturing/3D Printing | ◆ Automotive | ◆ Bioplastics |
| ◆ Blow Molding | ◆ Building and Infrastructure | ◆ Color & Appearance |
| ◆ Composites | ◆ Decorating and Assembly / Joining | ◆ Electrical & Electronic |
| ◆ Engineering Properties & Structures | ◆ Extrusion | ◆ Failure Analysis |
| ◆ Flexible Packaging | ◆ Foams | ◆ Injection Molding |
| ◆ Rheology | ◆ Medical Plastics | ◆ Mold Technology |
| ◆ Plastic Analysis | ◆ Plastic Pipe and Fittings | ◆ Plastics Recycling |
| ◆ Polymer Analysis | ◆ Polymer Modifiers & Additives | ◆ Product Design & Development |
| ◆ Rotational Molding | ◆ Thermoforming | ◆ Thermoplastics Materials |
| ◆ Thermosets | ◆ Sustainability | ◆ Vinyl Plastics |

A full manuscript submission is required and will be due towards end of October 2020. Your paper will be published as part of the ANTEC® 2021 proceedings.

FOR MORE INFORMATION PLEASE CONTACT

[Mark Spalding](#)

Technical Program Co-Chair



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Scholarship Opportunities

This is an SPE CAD Scholarship Information Reminder for the 2021/2022 School Year. The Society of Plastics Engineers Color and Appearance Division have scholarships available for qualified individuals.

Each year, scholarships are awarded in honor of some of those who have influenced our industry through education of up to \$4,000 each. Additional full or partial scholarships may be awarded based on available funding and on the number of qualified applicants.

Jack Graff Memorial Scholarship	up to \$4000.00
Gary Beebe Memorial Scholarship	up to \$4000.00
Bob Charvat Memorial Scholarship	up to \$4000.00
Steve Goldstein Memorial Scholarship	up to \$4000.00
George Rangos Memorial Scholarship	up to \$4000.00

For questions on applications or process please email [Ann Smeltzer](#), or call her at 412-298-4373

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Group Name: SPE Color & Appearance Division

Group ID 152108

<https://www.linkedin.com/groups/152108>



Milliken introduces KeyPlast RESIST™: A spectrum of bright, high-performance colorants for engineering plastics

New portfolio designed specifically for coloring polyamides and high-heat engineering plastics

Milliken & Company, recognized as a worldwide leader of plastic additives and colorants, announced the launch of KeyPlast RESIST™, a spectrum of bright, high-performance colorants for engineering plastics.

Polyamide resins and high-heat engineering polymers present unique challenges in the world of plastics. The materials of choice in demanding electrical, automotive and industrial applications, polyamide resins and high-heat engineering polymers are subject to high-temperature processing and require steady, reliable performance properties, making vibrancy of color difficult to achieve.

Milliken has addressed this challenge with its KeyPlast RESIST range of colorants. These products are specially designed for coloring engineering polymers such as polyamides, polyimides,

PBT polysulfones, PEEK, PPO and other high-heat resins and alloys. KeyPlast RESIST colorants can be used effectively with unfilled, glass-filled, and flame-retardant grades of various polyamide types such as polyamide 6, 66, 46, and other high temperature engineering polymers.

"Keyplast RESIST meets the strong requirements in another fast-growing application area—that of electrical vehicles and their charging system requirements," said Sami T.K. Palanisami, Milliken Global Product Line Manager, Plastic Colorants.

The new range delivers the brilliant, consistent colors — including bright orange, yellow, red, blue and green—and the high-end properties that users demand. These colorants offer improved weather resistance and light fastness, are high purity and perform well in the high-temperature and chemically-reductive conditions typically associated with high-performance polymers.



Milliken introduces KeyPlast RESIST™: A spectrum of bright, high-performance colorants for engineering plastics. (Photos © 2020 Milliken & Company, all rights reserved, MKPR209)

For more details and information please contact us or visit us online at chemical.milliken.com

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LATIN AMERICA : lachem@milliken.com | **ASIA** : asiachem@milliken.com

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EVALUATING THE APPEARANCE OF PLASTIC PARTS

A Simple Method for Ensuring a Consistent Look and Feel

Eric R. Larson, P.E., Art of Mass Production, San Diego, CA



Abstract

The appearance of a molded plastic part is often an important design element. Appearance involves color, and also texture and gloss, lighting and viewing conditions, and the perspective of the viewer. While each of these can be defined and hopefully controlled, the methods can be expensive, and the terminology is often confusing.

This paper presents a method for specifying and evaluating appearance in a simple and easy to understand manner. The method can be used at any phase of the development process, from initial concept to the factory floor. Properly implemented, it provides a practical and cost effective means to ensure consistent appearance in molded plastic parts.

Color vs. Appearance

Color is a complex subject, and a thorough discussion is well beyond the scope of this paper. At a basic level, the term *color* describes the transmission of visible light. It involves the wavelengths of the light source, how they are reflected by the object that is being viewed, and how they are received - and perceived - by the viewer.

The term *appearance* is used to describe an overall impression of something. It addresses the manner, condition, state, or style of something that is being viewed. It involves the color of the object, but also the texture and gloss level of the object as it reflects light. All of these can be affected by the shape and form of the object, and by its surroundings. Furthermore, the presence of cosmetic defects (flow lines, knit lines, parting lines, gate vestige, gate flush, dark specs, etc.) will also affect the appearance.

Texture

Texture plays a critical role in appearance. In plastic parts, the term refers to surface texture, and is used to describe the physical condition of the part surface. Anyone who has ever held a textured plastic color chip can tell you that the appearance changes as the texture changes over the surface of the chip.

When we describe the surface texture of a molded part, we typically think of the textures (plural) that were on the surface of the mold, which have been transferred to the surface of the part. Mold textures are usually specified in great detail. However, we often forget that the textured surfaces in the molded part are NOT a perfect replica of the textured surfaces that were in the mold. The molded part will have surface imperfections, minor deviations here and there, etc. Even if the mold surface was highly polished, the molded plastic part will NOT have the same level of smoothness as the tool. Furthermore, I would postulate that every thermoplastic material will have its own unique signature in how it replicates the mold surface. I think of this as the material texture.

In addition, unlike metal fabrication, molded plastic parts rarely undergo any secondary finishing processes (buffing, polishing, etc.). So the surface texture on a plastic part is typically an “as fabricated” texture, and will be dependent on the specific plastic material as much as the mold texture (and also the processing conditions). Unfortunately, there is no published data on material texture for plastic materials, as far as I know.

Gloss

The term gloss describes the manner in which an object reflects light. The object can reflect light in a pure mirror-like fashion (known as a specular reflection), it can scatter the light in a number of different directions (known as diffuse reflection), or it can absorb the light. There can also be a combination of all three. Many people confuse the term gloss with the concept of smoothness. However, gloss is not a description of surface smoothness (or roughness), it is an innate property of the material. As an example, a marble surface, even when polished perfectly smooth, will not provide a pure specular reflection like a common mirror, which is usually made by taking a piece of polished glass and coating it with a thin layer of aluminum or silver. Both aluminum and silver are high gloss materials, whereas marble is a lower gloss material.

The concept of gloss can be explained by the sheen (the shiny-ness) that is offered in various paint finishes, which can range from very dull (also known as flat or matte), and then getting progressively more shiny as the gloss level increases, from flat through eggshell, satin, silk, semi-gloss, and high gloss. Note: these terms are not standardized, and while the color or surface smoothness of the paint does not change, the final appearance most definitely does.

Unfortunately, gloss levels of thermoplastic materials are rarely reported. Some materials, like ABS and polycarbonate, have an intrinsically high gloss level, and they come out of the mold with very high gloss, looking shiny and bright. Other materials, like polypropylene, have a lower gloss level, more like a semi-gloss. As a result, they come out of the mold looking a bit duller. And with some materials, like nylon and polyester, the gloss level can be affected by the processing conditions. Also, additives can affect gloss, not just reinforcements like minerals or glass fiber, but also processing agents, heat stabilizers, etc. So selecting a material to achieve a certain gloss level can be a bit of a challenge. Quite often, this kind of information can be considered privileged and proprietary information, or as a matter of tribal knowledge.

Material Color

Finally, there is the natural color of the material itself. Every thermoplastic material has its own innate color. Some are clear, some are a milky white, others are brown, some are even black. (A thermoplastic material in its innate color state is referred to as natural, regardless of the exact color.) Furthermore, every thermoplastic material responds to pigments in a different way. These pigments—whether they be dyes, solids, powders, or flakes—interact with the base resin to create the final color of the molded part. However, how the material responds to the pigment is a critical aspect of the overall appearance. Is the final color rich and vibrant? Or is it dull and muted? Does the pigment affect the surface texture? Does it affect the gloss level of the material?

Color Specifications

Most manufacturers of plastic parts go to great lengths to create color specifications. The process usually begins with a master sample. This master

sample could be a physical prototype, a painted swatch, a sample of another molded part, etc. Often there is a unique master sample for each material and each color. Sometime a master sample is used for multiple materials.

These master samples represent appearance targets. They are used to define the intended color, texture, and gloss of each material used in the final product. Some design teams rely on mathematical descriptions of color (using CIE LAB values, or color codes from Munsell, Pantone, etc.). They may also define the mold texture in different areas, such as SPI A3 high polish, or a specific texture from MoldTech.

The master samples are then used by a color lab to create a specific color recipe for each plastic material. The lab will provide molded color chips, which the design team will evaluate under controlled lighting and viewing conditions. The goal is to have molded plastic chips with the desired color, texture, and gloss. Often, the primary focus is on color matching, and texture and gloss are overlooked. The process may need to be repeated a few times, but eventually there will be a defined color recipe for the selected material with an approved color code.

In most cases, the color matching process is done before the production molds are ready. And while texture is often included in the evaluation process, the texture of the sample chips may not be the same as the original master sample, and the texture of the final molded parts may be different from both. And gloss levels are rarely evaluated. So while the color match may be perfect, the appearance of the final molded parts may be different than the original master sample. If this occurs, a decision has to be made. Do you repeat the color matching process (to adjust the appearance of the molded parts closer to the targets)? Or do you adjust the targets, and approve the appearance of the molded parts? In this is the case, new master samples should be made, using actual molded parts.

While the “color matching” process is simple, color and appearance is a complicated phenomena, and the conversations often get ugly.

Appearance Specifications

In conjunction with color specifications, most manufacturers have basic appearance requirements, but the evaluation criteria is missing. The requirements are generic in nature, and open to interpretation, e.g.:

PARTS TO MATCH APPEARANCE OF
APPROVED MASTER SAMPLE.

NO BLEMISHES, HAZE, SHRINK MARKS,
WELD LINES, OR DRAG MARKS PERMITTED.

All parts should have detailed specifications regarding appearance. The specifications should address the requirements of the part in its end use environment, and provide *specific* details regarding its color, texture, gloss, embossing details, parting lines, gate locations, etc. Most important, the specifications should address *how* the appearance is going to be evaluated. Some manufacturers use a blanket description of “no visible difference” from an approved master sample. However, visual comparison involves a number of variables, all of which have unique tolerances.

Visual Comparison

Visual comparison is a common inspection method. It is used all over the world, in all industries, and by people from all walks of life. Under controlled conditions, it can be reliable and repeatable. The first set of variables to be defined (and controlled) involves the viewing conditions.

Lighting

Lighting is the foundation of any visual inspection. The type of lighting needs to be defined (incandescent light, cool-white fluorescent, sunlight, all of the above, a combination, etc), and well as the intensity (measured in lux or ft-candles). The location of the light source is also important, along with its relationship to the viewer, and the object being viewed. The style of the lighting is also critical, whether it is direct, diffuse, spot, or spread, etc.

Viewing Space

The second key variable is the viewing space. This is the room where the inspection takes place, and involves the floor, the walls, the ceiling, the

table tops, and the place where the object is being viewed. The defined lighting can be affected by the room layout, including the background colors, other light sources in the room, even the location of doors and windows.

A common practice is to use a viewing station. This can be a commercially produced piece of equipment, or something as simple as a white cardboard box. The primary requirement is that the viewing space is controlled and consistent.

The Viewer

The third key variable is the viewer. By this we are referring to a specific individual, as they look at the part, under the previously defined conditions. Most of us are familiar with the phrase, *Beauty is in the eye of the beholder*. However, this phrase implies an assessment of beauty, which involves not just observation, but a subjective analysis of the thing being viewed. In visual inspection, we are seeking an objective description, basically an answer to the question: *What do you see?*

Of course the answer to this question will depend on the viewer, and it will be influenced by their visual acuity, their sensitivity to light and color, and whether or not they are color blind. All of which may be affected by their age and gender, their race, cultural heritage, and whether or not they wear eyeglasses or contacts. Despite all this, the fact remains that the human eye is good at detecting differences.

Evaluating Appearance

Once the viewing conditions are defined, the next step is the evaluation of the appearance. The DTD Method uses 3 simple variables, involving a combination of distance, time, and distance (DTD).

Viewing Distance

For many products, a common viewing distance is “arms length” – roughly the distance from your eyes to your fingertips. Obviously that distance varies from person to person, and on the position of your hands in relation to your face. Another common distance is “close-up” – roughly the distance from your eyes to the tip of your nose. Again, that distance will vary from person to person. For evaluation of appearance, the important thing is to quantify the viewing distance.

Viewing Time

Can you take a quick look at this? We have all been asked this question, at various times in our careers. But what exactly is a “quick look?” Is it 2 seconds? 10 seconds? A minute? A couple of hours?

The period of time that you look at something is a critical variable in evaluating appearance. It is also a filter of sorts. When you specify the viewing time, you are defining a specific user experience.

Separation Distance

The final variable in the evaluation process is the separation distance – the distance between the master sample and the part under evaluation. The distance could be zero – meaning the two are next to or on top of each other. This is a common situation, and often the default condition.

For some applications, it can be useful to specify a separation distance. For example, let’s say you are molding two different parts that will be used on a bicycle. One part will be used in the drivetrain, the other part is a shift lever, located on the handlebar. These parts are molded from the same material, using the same color. What is the real requirement for their appearance? Do you really need to have a perfect match when positioned next to each other?

Detecting the Difference

Using these three variables of distance, time, and distance, a manufacturer can establish appearance requirements that are easy to quantify and understand, and that also meet the expectations of the end user. Instead of asking, “do these match?”, the question then becomes, “Under these defined conditions, can a viewer Detect The Difference (DTD)?”

Language and Terminology

The language of color can be confusing. Most of us are familiar with the concept of a color wheel, and the basics of red, yellow, and blue (RYB) as primary colors. Of course, this only applies when discussing subtractive color mixing, and we all know that the RYB model has been replaced by the CMY model (Cyan, Magenta, Yellow), or the CMYK model (which adds black to the mix). Then

there is additive color mixing, where the primary colors are Red, Green, and Blue (RGB).

Then there are the nuances, including hue, value, lightness, luminance, saturation, and color temperature. To say nothing of pigment dispersion, metamerism, texture, and gloss.

You say it's too blue, I say it's so you

As a plastics engineer, my job is not to tell someone what color(s) they should use. My job is to provide a design team with the right technical information so they can design a product that not only meets the needs of the end user, but is also manufacturable. It is important to remember that all manufacturing processes have some inherent variability. As such, a design specification should address tolerances, which describe the permissible level of variation. The variation is often described using the greek letter Δ (delta). In the world of color and appearance, there are tolerances in many different areas.

Appearance Tolerances

Δ Color
 Δ Texture
 Δ Gloss

Viewing Condition Tolerances

Δ Lighting
 Δ Viewing Space
 Δ Viewer

Evaluation Tolerances

Δ Viewing Distance
 Δ Viewing Time
 Δ Separation Distance

The Bottom Line

While tolerances can be established for all of these items, the ultimate goal is to provide parts with an appearance that meet the needs and expectations of the end user. The basic requirement stays the same: “Under these defined conditions, can a viewer detect the difference?” Or, to put that in engineering terms, what is Δ See?

Discussion

The DTD Method presented in this paper is one example of appearance evaluation using visual comparison. It does not pretend to provide a final answer on the topic. It is intended to spark discussion and shed light on a facet of our profession that is poorly understood, and often neglected.

It is important to remember that there is no perfect answer to the question, “*What is the right appearance?*” Instead, we propose a simple method of visual comparison - using a *Goldilocks and the Three Bears* kind of evaluation – in order to achieve a look and feel that is “just right”.

Conclusion

Evaluating the appearance of a plastic part can be a challenging task for anyone in the supply chain. The evaluation is often subjective and imprecise, the language can be confusing, and every individual sees things differently. The fact is that part appearance can be a determining factor in a buying decision to choose one product over a competitor’s.

The implementation of a visual comparison method can make a significant impact on a company’s bottom line, and is especially useful when used in conjunction with other quantitative methods.

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The CAD Division posts the board minutes as soon as approved and they are accessible on our website.

[Click here](#) to review our board minutes.

INVITATION TO ATTEND OUR BOARD MEETINGS

The Color and Appearance Division regularly holds Board of Director (BOD) meetings at the ANTEC® and the CAD RETEC®. In addition, a Summer BOD meeting is typically held about 6 weeks prior to the next CAD RETEC®.

The Summer meeting is scheduled in various locations. A Winter BOD meeting is held in January. The Winter meeting is typically held at a site of a future CAD RETEC®.

Any SPE CAD members who wish to attend are welcome at these meetings. If interested in attending the next Board meeting, please contact the Division Chairperson for more information.

Summer 2020



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