



COLOR &
APPEARANCE

CAD NEWS[®]
FALL 2024 NEWSLETTER

RETEC 2024
SCHEDULE & EVENTS

TECHNICAL ARTICLE

**OPTIMIZING COLOR: A PIGMENT- AND
SURFACE-CHEMISTRY PERSPECTIVE**

CHRISTOPHER W. BEIER, PH.D., CLARIANT PLASTICS
AND COATINGS USA INC., CHARLOTTE, NC 28205



FALL 2024 CHAIRMAN'S MESSAGE

Wow! It is now September, and the summer of 2024 is almost behind us! We had a challenging summer meeting dealing with Tropical Storm Debby who decided to abruptly interrupt our Tampa meeting but, some stoic warriors did make it live and help convert the meeting to a successful Virtual/Live event. I cannot thank you enough for your support and making this happen. We welcome our new Board Member Onur Ege Onar of Mine Colours and his enthusiasm to the team. Please extend a hearty congratulations to him when you see them at our RETEC® meeting next week.

Speaking of the RETEC® meeting, this will be our 62nd Annual Society of Plastic Engineers Color and Appearance Division RETEC® and we hope that you will come and join us to meet and discuss topics related to plastics coloration. This year's theme is Sailing Away with Color! CAD RETEC® is the longest running and largest technical conference in North America devoted to the coloring of plastics.

I would be remiss if I did not thank outgoing Chair Alex Prosapio for the support and smooth transition. I am extremely grateful to him. In addition, I want to thank the companies that allow all of us to support CAD - from the Board of Directors to RETEC attendees. Collaboration and education are essential, and we are pleased that these companies recognize the value of this.

In closing, I look forward to a productive year working with a great group of volunteers as CAD Chair. Please do not hesitate to contact me with any comments or suggestions for the Color and Appearance Division, and I look forward to Sailing Away with Color in Tampa.

GEORGE IANNUZZI

Color and Appearance Division Chair
george@koelcolours.com

SPONSORS

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Milliken presents

Milliken: The Color Experts

Milliken & Company understands the power and value of color as it relates to branding. Humans are visual creatures, and color plays a key role in purchasing decisions, as it helps to inform, personalize and speak the brand language.

The company continues to tap into its vast experience in this space to develop solutions for a wide variety of end markets and end-use applications.

Milliken's color journey began in 1964, when it launched its proprietary Versatint® washable colorants for textile identification. In 1981, it introduced its Reactint® range of colorants for polyurethane (PU). Five years later, Milliken unveiled its ClearTint™ polymeric colorants for use in NX® UltraClear™ polypropylene (PP), which can be made only with its Millad® NX® 8000 clarifier.

The year 2019 marked a major step forward, with the introduction of both its KeyPlast® products, as well as its KeyPlast RESIST™ high-performance colorants for plastics.

Milliken technology helps to color a vast range of sectors, including agriculture and turf; automotive and transportation; building and construction; coatings, paints and inks; home and laundry care; and plastics.

Milliken's KeyPlast RESIST colorants address another key challenge — coloring high-performance engineering polymers with bright and vibrant hues. These colorants are used in the high demanding applications such as high voltage connectors, control systems, structural parts and metal replacement.

Using KeyPlast RESIST colorants compounders and resin producers, offer a vast spectrum of stable and reproducible colors suitable for use with a wide range of resins such as Polyamides, PPA's, Poly Sulphones and other high heat polymer blends and alloys.

Additionally, Milliken continues to keep its finger on the pulse of end-user and market trends, which it documents each year in its ColorDirection report that forecasts the key shades and hues for the coming year. In doing so, it offers a palette of carefully curated colors, while providing the stories behind the inspiration and motivation driving their popularity. Brand owners can leverage this expert information to help capture the mood of consumers through effective branding and personalization.



Milliken's diverse portfolio of colorants can enable product makers to realize their aims to deliver on those colors that will help drive and shape consumer preferences in the coming year.

From the R&D lab to the production floor, Milliken's Chemical Division stands ready to help customers leverage color to design new products, reinvigorate existing products, and create opportunities to grow in new markets and applications.



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

EUROPE : eurochem@milliken.com | NORTH AMERICA : millichem@milliken.com
LATIN AMERICA : lachem@milliken.com | ASIA : asiachem@milliken.com

Milliken

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THE RETEC APP

1. Download the app from the app store available on your device or go directly to the mobile-friendly website on your mobile device's browser.

2. Once you open the app for the first time, enter the email address used to register for CAD RETEC® 2024.

3. Set up your password or, click on the "send me a magic link" to receive an email which will log in automatically.

4. Select the "SPE-Inspiring Plastics Professionals" Organization.

5. Select the "SPE Color and Appearance Conference 2024 (CAD RETEC®)"

6. You should now be on the landing page of the app for the CAD RETEC® 2024 event.





The Shepherd Color Company
We Brighten Lives



2024 CAD RETEC® TABLETOP EXHIBITORS

COMPANY

COMPANY

AMI	M. HOLLAND COMPANY
AZELIS AMERICAS	MAYZO INC.
BARENTZ	MILANA COLORS LLC
BRILLIANT GROUP INC.	MILLIKEN & COMPANY
BUCKEYE COLOR	MIXACO USA
BYK-GARDNER USA	OXERRA
CHROMA SPECIALTY CHEMICALS	PARAMOUNT COLORS INC.
CINIC	PCBL, LTD
COLOR PIGMENTS MANUFACTURERS ASSOCIATION	Q-LAB CORPORATION
COLOUR SYNTHESIS SOLUTIONS	ROYCE GLOBAL
COVIA	SINCOL USA
DATACOLOR	SPECTRA DYESTUFF INC.
DAY GLO COLOR CORPORATION	SUDARSHAN NORTH AMERICA
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KOEL US	US SILICA
LEISTRITZ EXTRUSION	VIBRANTZ TECHNOLOGIES
LIBERTY SPECIALTY CHEMICALS	VIVIFY COMPANY
LINTECH INTERNATIONAL LLC	YIPIN USA

WELCOME RECEPTION

Sponsored by: Milliken & Company

Florida Salon IV-VI

Monday, September 23RD | 8:00pm – 11:00pm

Join us for cocktails, networking and light snacks

Complimentary with Registration
Use the **GREEN** drink tickets.

EXHIBIT SCHEDULE

Grand Salons E-J

Tuesday, September 24TH | 10:00am – 7:00pm

Wednesday, September 25TH | 9:00am – 3:30pm
(closed during lunch)

NETWORKING RECEPTION

Sponsored by: Liberty

Grand Salons E-J

Tuesday, September 24TH | 5:45pm – 7:00pm

Complimentary with Registration
Use the **GOLD** drink tickets.

TUESDAY BREAKFAST

Sponsored by: Shepherd Color

Florida Salon IV-VI

**Tuesday, September 24TH |
7:30am – 8:30am**

Complimentary with Registration!

LANYARDS

sponsored by sudharshan

CHARGING STATION

sponsored by torrecid usa

CAD SURVEY RAFFLE

Grand Salons A-D

**Wednesday, September 25TH |
4:00pm**

Complete your Survey and drop it off
at the Registration Desk for your
chance to win.

GRAND PRIZE

Bose QuietComfort Headphones and
many other great prizes!
* Must be present to win *

AWARDS LUNCHEON

Sponsored by: SPE CAD

Florida Salon IV-VI

Wednesday, September 25TH | 12:00pm – 1:00pm

Complimentary with Registration!

5K FUN RUN / WALK

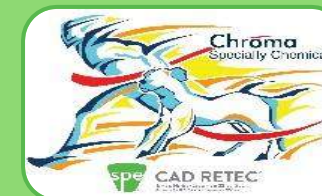
Sponsored by: Chroma Specialty Chemicals

TO BENEFIT HEIDI'S LEGACY DOG RESCUE

Wednesday, September 25TH | 7:00am in the Hotel Lobby

Start your Wednesday morning off right. Join us bright and early for a fun run/walk through the city of Columbus. You will be back in time to catch the first paper.

FREE T-SHIRT FOR THE FIRST 40 RUNNERS



**COST
\$25**

CAD will match your
donation

CONFERENCE INTERNET ACCESS

sponsored by royce global

KEY CARDS

sponsored by sun chemical

HOSPITALITY SUITES

While SPE CAD does not sponsor hospitality suites, we realize the importance of these functions to the conference attendees. Check hotel monitors and signs for times and locations of other suites operating during CAD RETEC® 2024.

PAPER DOWNLOADS

You will receive an e-mail from OmniPress for access



GET THE SPE EVENT APP

1. Scan QR-code and select Android or Apple to download SWAPCARD app.
2. Enter your e-mail address used to register for CAD RETEC® 2024
3. Set up your password or click on the "send me a magic link" to receive an email which will log in automatically. Click on Enter Event to continue into the site.
4. Select the "SPE-Inspiring Plastics Professionals" Organization.
5. Select the "SPE Color and Appearance Conference 2024 (CAD RETEC®)"
6. *If you already have the SWAPCARD app, select SPE Color and Appearance Conference (CAD RETEC 2024)*



CAD RETEC®

Tampa, Florida • September 23-25, 2024
Presented by SPE Color and Appearance Division



TECHNICAL PROGRAM

TUESDAY SEPTEMBER 24TH, 2024 | GRAND SALONS A-D

TIME	CATEGORY	SPEAKER/COMPANY	TITLE/SPONSOR
7:30-8:30AM	BREAKFAST		SPONSORED BY THE SHEPHERD COLOR COMPANY
8:45 AM	Opening Remarks	Alex Prosapio- Sudarshan	Welcome to CAD RETEC® 2024 in Tampa, FL
9:00 AM	Keynote	Scott Farmer- Techmer PM Board	Keynote: Plastics Industry Overview
9:30 AM	Keynote	Mike McHenry- Techmer PM CEO	Keynote: Plastics Industry Overview
10:00 AM	BREAK	EXHIBITS OPEN GRAND SALONS F-J	SPONSORED EMD ELECTRONICS
11:00 AM	Presentation	Mercedes Landazuri – Ampacet	Color Trends
10:30 AM	Presentation	Dave Wawer - CMPA	The Intersection of Customer Sustainability Pressures with Plastics Laws & Regulations: Educating Brand Owners About the Value of Color for Plastics and Packaging
11:30 AM	Paper	Bonnie Piro- Sudarshan	Pigment Selection Process: Balancing the “MUSTs, WANTs and the NICE TO HAVEs”
12:00 PM	LUNCH	ON YOUR OWN	
1:30 PM	Paper	Pat Ryan- Eckhart	Metallic Effect Pigments for NIR Detection and Automatic Sorting
2:00 PM	Paper	Jack Ladson – Color Consultants	Enhancing Precision and Improving Colorimetric Representation in Reflectance Spectroscopy: A Comparative Analysis of Aperture Diameters Minimizing Variance on the Way to the Mean.
2:30 AM	Paper	Arno Boehm - ColorFlex Functional Colorants	Advances in Solar Energy & Heat Management for Automotive & Architectural
3:00 PM	BREAK	EXHIBIT AREA GRAND SALONS F-J	SPONSORED BY TRUST CHEM USA
3:30 PM	Paper	Arno Boehm - ColorFlex Functional Colorants	High Speed Laser Marking for Cable & Wire
4:00 PM	Presentation	Steven Kerr- MetaFlake LTD.	“Plain Sailing” – simplify your product compliance and sustainability with the “greenest” aluminum and effect pigments
4:30 PM	Presentation	Kelly Montilla - Milliken	Enhancing Color Stability in Nylon Resin for Premium EV Components: Attaining RAL 2003 Orange with KEYPLAST RESIST XTR 9798 and Advanced Heat Stabilization
5:00 PM	NTF	MODERATOR: TONY TANNER - BAERLOCHER USA	NEW TECHNOLOGY FORUM



NETWORK RECEPTION

Tuesday, September 24, 2024
Exhibitor Area, Regency Ballroom 5:45 pm – 7 pm
Sponsored by **Liberty Specialty Chemicals**

new technology forum

Tuesday, September 24TH
5:00pm | Grand Salons A-D

The purpose of the **new technology forum** is to provide an opportunity for people involved in the coloring of plastics to hear about the newest materials and services available. The Forum is a series of 5-minute presentations by the companies that are bringing the technology to market. These presentations are not subject to the rules that apply to presentations during the technical paper sessions and will not be included in conference preprints.

- Presentations are limited to 5 minutes with no questions.
- The time limit will be strictly enforced
- Participants must comply with all anti-trust regulations.
- No pricing information is to be discussed

MODERATED BY TONY TANNER, BAELOCHER USA

Don't miss the chance to hear about new offerings from these exhibitors. Tony Tanner, Baelocher USA, will moderate the session.

The Networking Reception will follow in the Grand Salons E-J, sponsored by **Liberty Specialty Chemicals**.

TIME	ORGANIZATION NAME
5:00 PM	Introduction
5:05 PM	EMD Electronics
5:10 PM	The Shepherd Color Company
5:15 PM	Buckeye Color
5:20 PM	Colour Synthesis Solutions
5:25 PM	Chroma Specialty Chemicals
5:30 PM	PCBL
5:35 PM	First Source Worldwide LLC
5:40 PM	H. L. Blachford Ltd.
5:45 PM	BYK-Gardner USA
5:50 PM	Q-Lab Corporation
5:55 PM	United Mineral and Chemical Corporation
6:00 PM	Sudarshan North America
6:05 PM	Sun Chemical
6:10 PM	Paramount Colors Inc.



CAD RETEC®

Tampa, Florida • September 23-25, 2024
Presented by SPE Color and Appearance Division



SUSTAINABILITY & REGULATIONS

PANEL DISCUSSION: WEDNESDAY AT 11:00 AM



TECHNICAL PROGRAM

WEDNESDAY, SEPTEMBER 25, 2024 | GRAND SALONS A-D

TIME	CATEGORY	SPEAKER/COMPANY	TITLE/SPONSOR
7:00 AM	ACTIVITY	FUN RUN/WALK (HOTEL LOBBY)	SPONSORED BY CHROMA SPECIALTY CHEMICALS
8:00 AM	PRE-CONF BREAK	EXHIBIT AREA GRAND SALONS F-J	SPONSORED BY ECKART
8:50 AM	Opening Remarks	Alex Prosapio- Sudarshan	Welcome Day 2
9:00 AM	Keynote	Rachel Bond- Keller and Heckman	<i>U.S. state laws and other emerging issues affecting food-contact materials</i>
9:30 AM	Keynote	Eric Andrews- Colour Synthesis	<i>EU Regulations</i>
10:00 AM	BREAK	EXHIBIT AREA GRAND SALONS F-J	SPONSORED BY TOMATEC
10:30 AM	Presentation	Breeze Briggs- Sun Chemical	<i>Plastic Sustainability: Can the Measurement of Tangibles Help Guide the Industry Toward More Impactful Change?</i>
11:00 AM	Panel	Moderator Doreen Becker - Ampacet	<i>Panel Discussion: Sustainability</i> Leslie O'leary, DOW; Lynzie Nebel, Cytiva; Rachel Bond, Keller and Heckman Eric Andrews, Colour Synthesis
12:00 PM – 1:30 PM	LUNCHEON	AWARDS LUNCHEON	SPONSORED BY TBD
1:30 PM	Paper	Chris Ahmer- U.S. Silica	<i>Evaluation of a new white pigment in LDPE masterbatches and compounds</i>
2:00 PM	Paper	Andy Francis – Q-Lab	<i>Temperature Control in accelerated weathering testing in polymers</i>
2:30 PM	BREAK	EXHIBIT AREA GRAND SALONS F-J	SPONSORED BY VIVIFY
3:00 PM	Presentation	Christine Gehres	Increase Customer Satisfaction and Grow Your Business in the Digital Age
3:30 PM	Paper	Salvatore Monte	<i>Nano-Organometallic Chemical Functionalization of the Carbon Interface</i>
4:00 PM	Closing Remarks	Alex Prosapio- Sudarshan	Closing Remarks & Raffle (must be present to win)
5:00 PM			CONFERENCE ENDS

Please join us for an esteemed panel of industry experts to discuss the current, new and future sustainability regulations that will impact our industry. Some of the topics we will cover include Changing Recycling Standards, Plastics Bans, North American Regulations, European Regulations (including UK), Asian Regulations, and the UN Global Plastic Pollution Treaty.

Panelists:

Eric Andrews, Technical Services Manager, Colour Synthesis Solutions
Rachel Bond, Partner, Keller and Heckman LLP
Lynzie Nebel, Upstream Quote Engineer,
Cytiva
Leslie O'Leary, R&D Director, Dow

Moderator: Doreen Becker, Global Sustainability Director, Ampacet Corporation



PlastiVan® at CAD RETEC®

Tuesday, September 24th

Room: Florida Salon I-III

Join PlastiVan® on **Tuesday** as it brings **Positive Plastics Education** to Girl Scouts from the Tampa area at CAD RETEC®. Themes for the day will include **Color our World through Polymer Science**, including working towards a Girl Scout Patch.

Interested CAD RETEC® attendees who would like to see the PlastiVan® program in action are welcome to join our presentation in the Florida Salon I-III. PlastiVan® schedule:

- 9:00a Students Arrive at the hotel
- 9:15a Students view CAD RETEC® tabletops
- 10:00a Hands-on STEM activities/Opportunity to earn patch
- 11:15a Patch Award; Lunch; Q&A with female industry professionals
- 12:00p Students Depart hotel

HELP US CHANGE THE PERCEPTION OF PLASTICS ONE CLASSROOM AT A TIME!

2024 CAD RETEC® COMMITTEE

CHAIRPERSON	Alex Prosapio	Sudarshan
VICE-CHAIRPERSON/HOUSING	Mark Tyler	Eckart America
TECHNICAL PROGRAM	TJ Stubbs (chair) Karen Carlson Brian Coleman	Teknor Apex EMD Electronics Celanese
NEW TECHNOLOGY FORUM	Tony Tanner	Baerlocher
AUDIO/VISUAL	George Iannuzzi	Koel US
EXHIBITORS	Kimberly Williamson (chair) Brian West	Techmer PM West Color Technologies
REGISTRATION	Bruce Mulholland	Celanese (retired)
SPONSORSHIP	Cheryl Treat (chair) Scott Aumann Christine Gehres	Sun Chemical Chroma Colors Special Chem
TECHNICAL CONTENT REVIEW	Mark Ryan Betty Puckerin (chair)	The Shepherd Color Company Ampacet
PRINTING/PUBLICITY/WEBSITE	Matt Billiter Jeff Drusda George Iannuzzi	LANXESS Chemours Koel US
GOLF OUTING	Mark Tyler	Eckart America
RAFFLE	Chuck Depew	Holland Colours



CAD RETEC® 2025

CALL FOR PAPERS

SOCIETY OF PLASTICS ENGINEERS		
COLOR & APPEARANCE DIVISION		
2024 - 2025 OFFICES & BOARD OF DIRECTORS		
OFFICERS		
CHAIRPERSON	George Iannuzzi	Koel US
CHAIR-ELECT	Kimberly Williamson	Techmer PM
FINANCE CHAIR	TJ Stubbs	Teknor Apex
SECRETARY	Tony Tanner	Baerlocher
TREASURER	Bruce Mulholland	Celanese (retired)
COUNCILOR	Doreen Becker	Ampacet
IMMEDIATE PAST CHAIR	Alex Prosapio	Sudarshan

TERM	BOARD OF DIRECTOR MEMBERS			
2025	Scott Aumann Chroma Colors	Charles Depew Holland Colours	Jim Figaniak Americhem	Bruce Howie H.L. Blachford
	Scott Heitzman DCL	Betty Puckerin Ampacet	Mark Ryan Shepherd Color	Ann Smeltzer Huebach
2026	Matthew Billiter LANXESS	Karen Carlson EMD Electronics	Bennett Chin Techmer PM	Jeff Drusda Chemours
	Steve Esker Paramount	Christine Gehres Special Chem	Cory Singleton Formerra	Mark Tyler Eckart America
2027	Earl Balthazar Datacolor	Brian Coleman Celanese	Joshua Jacobs Uniform Color	Jack Ladson Color Science
	Mercedes Landazuri Ampacet	Bruce Mulholland Celanese (retired)	Unur Ege Onar Mine Colours	Cheryl Treat Sun Chemical

HOTEL CLEVELAND, AUTOGRAPH COLLECTION

(CAD RETEC® 2019 VENUE)

Cleveland, Ohio |

September 15 – 17, 2025

DEADLINE FOR ABSTRACTS IS FEBRUARY 2025

Chairperson:

Josh Jacobs, Uniform Color

JOSHUA.JACOBS@AUDIA.COM

Vice-Chairperson:

Jeff Drusda, Chemours

JEFFREY.DRUSDA@CHEMOURS.COM

Technical Program:

Doreen Becker, Ampacet

DOREEN.BECKER@AMPACET.COM

**SOCIETY OF PLASTICS
ENGINEERS
2024 CAD RETEC®
GOLF
OUTING**

MONDAY 09.23.2024
**INNISBROOK RESORT
ISLAND COURSE**

COURSE LOCATION
1402 Innisbrook Dr,
Palm Harbor, FL 34683
PH: (740) 524-4653

SCHEDULE (EST)
Registration: 7:30am to 9:00
Split Tee Times starting at 8:21
to 9:03 on 1 and 10

PRICE
\$115.00 per golfer
Includes: Range, Green and Cart Fees

AWARDS (HOLE PRIZES)
Scramble Format – Teams will be drawn based on
handicaps again this year



Look forward to picturesque views and challenging play for golfers of all levels. Considered to be equally, if not more, demanding as Copperhead, the Island course features tight fairways, intimidating water hazards, abundant bunkers, and extraordinary elevation change rarely found in Florida. The finishing hole tests the greatest players and is one of the most photographed in Florida. The Island course has been ranked among the country's Top 50 Resort Courses by Golf Digest; and has hosted numerous U.S. Open Qualifiers, NCAA Championships, and the LPGA TOUR's Legends Championship.

WHEN REGISTERING, INPUT YOUR HANDICAP TYPICAL 18 HOLE SCORE.
PLEASE BE HONEST TO MAKE THIS FAIR.

QUESTIONS CONTACT: MARK TYLER (570) 952.5255 OR ALEX PROSAPIO 845-641-0596



Society of Plastics Engineers Color & Appearance Division
ENDOWMENT SCHOLARSHIP PROGRAM
 FOR THE 2025 – 2026 SCHOOL YEAR



The Endowment Scholarship Program offered by the Color & Appearance Division of the Society of Plastics Engineers awards multiple scholarships each year to students who have demonstrated or expressed an interest in the coloring of plastics industry. The students must be majoring in or taking courses that would be beneficial to a career in this industry. This would include, but is not limited to, plastics engineering, polymer science, coloring of plastics, chemistry, physics, chemical engineering, mechanical engineering, industrial design and industrial engineering. All applicants must be in good standing with their colleges. Financial need is considered for most scholarships.

Undergraduate and graduate scholarships have ranged up to \$4,000 annually. Scholarships are awarded for one year only, but applicants may apply for a re-award for each year they are enrolled in school.

SCHOLARSHIP ELIGIBILITY

1. Applicants for these scholarships must be full-time undergraduate students in either a four-year college or a two-year technical program or enrolled in a graduate program.
2. All applicants must be graduates of public or private high schools.

SCHOLARSHIP CRITERIA

1. Applicants must have a demonstrated or expressed interest in the coloring of plastics industry.
2. Applicants must be majoring in or taking courses that would be beneficial to a career in the coloring of plastics industry.
3. An applicant must be in good academic standing with his or her school.
4. Preference is given to student members of SPE and also to students who have a parent(s) as a member of the Color & Appearance Division of the SPE.
4. Financial need of an applicant will be considered for most scholarships.

APPLICATION PROCEDURE

To be considered for a scholarship from the Color & Appearance Division Endowment Scholarship Program, applicants must complete an on-line application in the Spring of 2025. Check www.specad.org for deadlines and for any additional updates to the process. All applications submitted must include:

1. A completed application form.
2. Three recommendation letters: two from a teacher or school official and one from an employer or non-relative.
3. A high school and/or college transcript for the last two years.
4. An essay by the student (500 words or less) telling why the applicant is applying for the scholarship, the applicant's qualifications, and the applicant's educational and career goals in the coloring of plastics industry.

For more information, visit www.specad.org or contact
 Ann Smeltzer at (412) 298-4373 or e-mail at ann.smeltzer@heubach.com

All scholarships will be paid directly to the recipients' schools. Schools must reside in the US and all funds are paid in US funds. The Color & Appearance Division Endowment Scholarship Program will not award scholarships to applicants who are not qualified and reserves the right to not award a scholarship in a given year if it so chooses.

CALL FOR CANDIDATES

COLOR & APPEARANCE DIVISION | BOARD OF DIRECTORS

WE NEED YOUR HELP – CONTINUE THE EXCELLENCE!

- Interested candidates for the 2025 Board of Directors should contact [Kimberly Williamson](#) or any Board Member, or indicate your interest on the questionnaire
- We will be soliciting candidates through the end of 2024
- Biographies due February 2025
- Elections will be conducted in Spring 2025
- If elected, term is 3 years (serve until 2028)
- There are 4 Board meetings per year to attend: Spring, Summer, CAD RETEC®, and Winter meetings
- Candidates must be members of SPE in good standing and members of the Color and Appearance Division





Sudarshan develops and manufactures a broad range of high quality organic and inorganic pigments, solvent dyes and mica effect pigments for the plastics, coatings, inks and cosmetics industries.

Sudaperm™ Sudafast™ Sudacolor™ Sudatherm™ Sudasol™ Sumica™



Spiritually fulfilled • Socially just • Environmentally sustainable

SUDARSHAN



SPE Color and Appearance Division Mission Statement

The Color and Appearance Division of SPE strives to educate, train, inform and provide professional interaction opportunities to the global community involved in visual performance and aesthetics of plastics.

INVITATION TO ATTEND CAD BOARD MEETING

The Color and Appearance Division (CAD) holds 4 Board of Directors (BOD) meetings each year, either in person or virtually. Any CAD members in good standing with in SPE and has Color and Appearance as their selected division are welcomed to attend these meetings. If interested in attending these meetings, please contact the current CAD Chairperson or any BOD for more information.

 **Liberty Specialty Chemicals**



**For all your color needs in
Pigments, Dyes and Chemicals.**

**For samples call us at
704-554-1487 or libertyscl.net**



Innovation looks good in any color.

Our team combines intelligence in industry trends and engineering with our dependable resin inventory, including MH Resolute™ and PCR-certified options, to help you create innovative products across the spectrum.



Innovate with M. Holland.
[mholland.com/our-markets/
color-compounding](http://mholland.com/our-markets/color-compounding)

CADNEWS® Technical Content – Scott Heitzman

The Technical Content portion of our RETEC 2024 edition of CADNEWS® includes a paper presented in 2018. OPTIMIZING COLOR: A PIGMENT – AND SURFACE-CHEMISTRY PERSPECTIVE. written by Christopher W. Beier, Ph.D. This paper reminds us it may be “on the surface not underneath”. Understand surface area, porosity, surface charge, and reactivity of your pigments and optimize color and strength!

If you have questions after the read, drop them to Color Notes and we will get back to you with answers from the committee.

CADNEWS® Color Notes – Scott Heitzman

Welcome to CADNEWS® Color Notes. Do you have a question regarding color and effects? Don't miss your opportunity to anonymously ask our team of experts. We can help create discussion as well as provide answers. Color, appearance, color measurements, and colorants in general are all in our scope. Use the link below to submit your questions. Our SPECAD Color Notes committee will provide a response in the upcoming CADNEWS®.

<http://specad.org/color-questions-for-cad/>

Abstract

Effectively dispersing organic pigments within polymeric matrices is essential in maintaining consistent color and physical properties. Each and every pigment is chemically and physically unique, allowing for a myriad of potential molecular and macroscopic interactions to take place. This paper will discuss the physical (e.g. particle size, shape, distribution, morphology, surface area, porosity, etc.) and chemical (surface energy, polarizability, zeta potential, solubility, hydrophilicity, hydrophobicity, etc.) properties impacting a pigment's interaction with its environment.

Introduction

Organic pigments, classically defined, are synthetic products based upon a base of carbon, hydrogen, and nitrogen which are insoluble in, and essentially physically and chemically unaffected by, the vehicle or substrate in which they are incorporated [1]. A pigment is considered to be particulate, either crystalline or amorphous in nature. The color achieved in pigments is a result of a complex combination of chromophores and auxochromes. A chromophore is an unsaturated chemical group responsible for the absorption of UV or Visible light radiation, e.g. C=C, C≡C, N=N, or NO₂. Auxochromes are chemical groups which, when attached to a chromophore, change both the wavelength and intensity of absorption thereby altering the appearance, e.g. -OH, -NH₂, -SH, and -Cl [2].

The characteristic chemistries inherent to all pigments allow for thousands of iterations impacting not only color, but how these complex molecules interact, forming primary pigment particles with unique particle size, distribution, shape, morphology, and surface chemistry [3]. In the traditional powdered form, pigments do not exist as primary particles but exist instead as an assemblage of hundreds or thousands of particles forming a complex, often irregular, thermodynamically stable superstructure. These superstructures are commonly referred to as agglomerates or aggregates and are stabilized through a combination of non-covalent, physical or electrostatic inter-particle bonds [4-5].

Dispersion is a process by which the inter-particle bonds are broken, and agglomerates are reduced into individual particles through the application of controlled chemical and physical energy. When properly dispersed, the particles are completely coated and uniformly

distributed within their matrix. Proper dispersion allows the user to achieve optimized color consistency, and color strength while reducing equipment down time (i.e. clogged filters or screens) [6].

Herein, the variables affecting the formation of agglomerates/aggregates will be explored and used to understand how a pigment can interact with its environment to either enhance or disrupt performance.

Agglomerate Formation

Pigment molecules, exhibit a strong tendency to form highly ordered crystalline assemblies, or particles, due to the nature of their structural features [7]. The formation of these assemblies are driven by hydrogen bonding, electronic stacking (π - π), and Van der Waal's interactions. The effect of such an interaction is generally believed to be a result of the pigment molecules seeking an energetically favorable state [5, 8-9]. While it is common for only a single stable crystal structure to form, many pigment molecules display polymorphism. Polymorphism is a phenomena in which molecules of the same chemical formula will arrange into two or more unique crystalline structures. For example, stabilized copper phthalocyanine is known to occur in at least five crystal modifications [5], the α -form (red-shade PB 15:1), the β -form (green shade PB 15:3) and the γ -, δ -, ϵ - forms. Regardless of the morphology of the pigment particle, the processing conditions (solvents, raw materials, etc.), can promote a range of particle shapes, sizes, and surface chemistries that can impact coloristic and physical properties [7]. While the exact mechanism is beyond the scope of this paper, it is important to note that these variables will have a

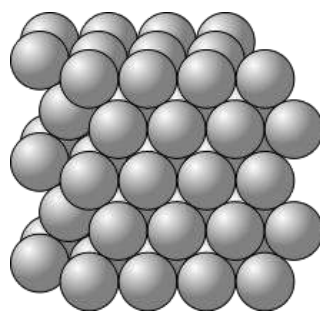


Figure 1. Close packing of spheres

measurable effect on the agglomeration behavior, and subsequent dispersion.

After synthesis and crystallization, pigments are isolated through filtration and/or drying. It is during this process that significant agglomeration occurs. Excluding chemical and physical forces, there is a geometric limit to how densely inelastic particles of a specific size and shape can pack. For example, Figure 1 displays an optimized packing situation for spherical particles of equal size. In this close packed structure, spherical particles can only occupy ca. 74% of the total volume in which they are enclosed, providing ca. 26% free space that can be filled by air or solvent. In reality, however, particles do not exist in a single size, but exist instead as a distribution of sizes. As the particle size distribution widens for this spherical example, the theoretical packing density can increase, potentially reducing the volume of free space in the agglomerate. When considering particles of non-spherical morphology (e.g. rods, plates, needles, irregular, etc.), the packing density can reach above 90%, preventing solvent impregnation into the agglomerate [3, 10-11].

Empirically, particles of a similar morphology can agglomerate in many different ways. For example, particles with plate-like morphology agglomerating in an edge-edge interaction would potentially be easier to disperse than the same plate-like particle coalesced in a face-face interaction. This is due to the increased volume of free space available for wetting the pigment surface. Some agglomerates forming large and complex superstructures, however, can lead to a reduction in flow of polymeric systems resulting in higher viscosity [12]. Sometimes, the surface chemical character of the agglomerate can also influence other mechanical properties of the application media, causing distortion or warpage in molded plastics [12].

Interaction	Origin
Electrostatic	Dissociating ions
Van der Waals	Electromagnetic interactions
Steric	Adsorbed polymers or surfactants
Solvation	Surface/solvent interactions
Hydrophobic	Capillary pressure

Table 1. Summary of particle-particle interaction forces affecting pigment stability.

While size and shape considerations are of practical use, the adhesion of particles during the agglomeration process is dominated by forces much greater than those posed by gravity. Inherently all suspensions are thermodynamically unstable. Organic pigment particles will aggregate (without intervention) because of the natural

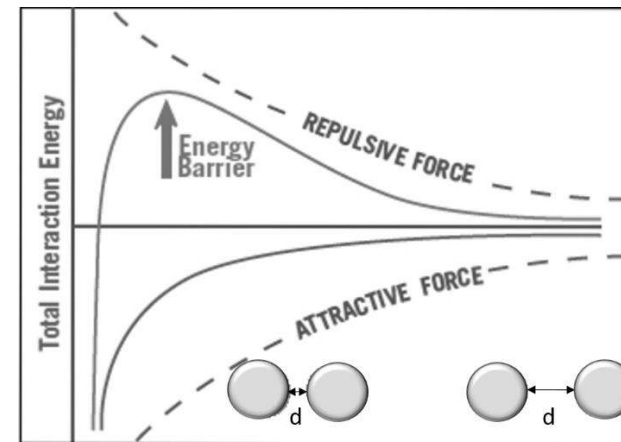


Figure 2. Total interaction energy of the attractive and repulsive forces of two particles as a function of distance.

and dominant tendency to decrease the large specific surface area and excess surface energy. This tendency becomes increasingly important as the size of the primary particle is reduced. For example, primary particle sizes of 5 nm have approximately 50% of all its atoms located at the surface, whereas particles of 150 nm in diameter display less than 1% of their atoms on the surface [13]. The total forces of adhesion acting on 1 μ m diameter particles can exceed the gravitational force acting on that particle by factors greater than 10⁶ [14]. There are two fundamental interactions between particles in suspension: attraction and repulsion. Whether two approaching particles will agglomerate, depends on the potential energy barrier between them. As pigment particles are dried, their concentration increases, reducing inter-particle spacing and subsequently increasing their interaction and subsequent attraction to each other (Figure 2). This potential energy barrier arises as a consequence of the difference in magnitude of the repulsive and attractive forces listed in Table 1 [14-15].

Particle aggregation and its negative effects can be controlled; however, by modification of the interfacial properties through introduction of functional molecules which will adsorb/adhere to the primary pigment particle surface. These interactions can be steric or electrostatic in nature. In a sterically stabilized system the physical distance of particles is increased through large molecular groups. Electrostatic or charge stabilization is possible, but is more prevalent in aqueous systems [14, 16]. While these modifications are advantageous, they will not guarantee dispersion and are in no way universal. The effectiveness of surface passivation on dispersion will vary significantly with processing method, matrix, and pigment manufacturer.

Pigment Wetting

Pigment wetting occurs when all the air is displaced from the surface of the pigment or agglomerate, being encompassed by a wetting agent, dispersant, or resin. The process of wetting an agglomerate involves an understanding of the pigment surface and the nature of the wetting agent used. For spontaneous wetting to occur, a balance must be struck between the inherent adhesive and cohesive forces of the pigment and wetting agent. This can be determined mathematically through the Young equation [17], and calculation of the solid/liquid interfacial and surface energies, the surface tension of the liquid, and the contact angle of the interface. Practically; however, the ability for a wetting agent to coat the surface of a pigment particle can be determined through an understanding of the pigment's relative surface charge, surface area, and porosity.

Surface Charge

The magnitude of charge near the pigment surface can be determined via measurement of the particle's zeta potential. During this measurement, suspended particles are subjected to an electric field. If charged, the particles will respond by physically displacing within the test solution by a process called electrophoretic mobility, with results recorded in mV. For aqueous suspensions, an electrostatically stabilized particle will generally have a zeta potential of ± 30 to ± 60 mV or greater [18]. While traditionally measured in aqueous systems, it is possible to determine the zeta potential in a range of solvents, given that the polarizability (dielectric constant) of the solvent is known. Zeta potential is commonly referred to as a surface technique, but the measurement actually represents the charge at a location distant from the surface called the slipping plane, as represented in Figure 3 [19]. Nevertheless, zeta potential is among the only available approaches that can quickly give quantitative information regarding the electrostatic environment surrounding a pigment. In application, a charged polar surface (high zeta potential) will be more effectively wet by dispersants that contain polarizable functional groups (e.g. $-\text{COOH}$ or $-\text{NH}_3^+$). Similarly, an uncharged nonpolar surface (zeta potential ~ 0 mV) may be wetted through aliphatic agents. The zeta potential for any given pigment chemistry is not fixed, and can be altered with the introduction of acids or bases [19].

Charging at the surface of a pigment in solution occurs through the ionization and dissociation of surface groups (e.g. proton disassociation from surface carboxyl groups) and by adsorption of ions from solution (e.g. binding of Ca^{2+} during pigment synthesis). These mechanisms are essential in the synthesis and stabilization of pigments [14]. A pigment with a positive surface will be neutralized with anionic wetting agents, affecting the chemistry at the

surface and its interaction with the medium in which it is being incorporated into. In a similar manner a positive pigment surface will become saturated with the addition of cationic wetting agents.

While electrostatic interactions can be a passive surface-only phenomena, the pH and chemistry of the wetting agent, dispersants, and resins could react with the pigment. This reactive interaction could alter the pigments crystal structure, increase agglomeration, and even physically dissolve the pigment. There is, unfortunately, no single approach to wetting, as two pigments can have similar surface charge but perform quite differently due to the unique physical and chemical properties.

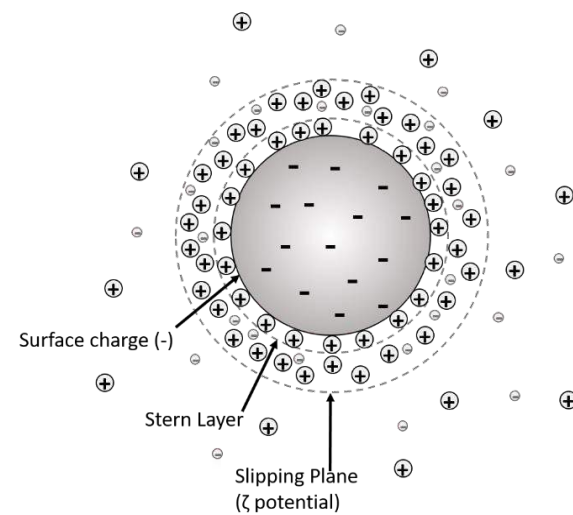


Figure 3. Schematic of the environment surrounding a negatively charged particle in aqueous solution.

Surface Area and Porosity

The surface area and porosity of dried pigment agglomerates can be determined by gas adsorption/desorption. During the gas adsorption process, an inert gas, typically nitrogen, is introduced into an evacuated chamber containing pigment that is cooled to liquid nitrogen temperatures. As the gas slowly enters the chamber, the pressure increases until the environment within the chamber reaches atmospheric pressure (condensing the adsorbed nitrogen). Once at ambient pressure, the gas is slowly removed via vacuum. The volume of gas per cubic centimeter is recorded and graphed against the relative pressure. The slope and shape of the adsorption/desorption isotherms can then be used not only to determine the surface area and porosity of the powder but also the nature of the pores contained within (pore volume and size). Porous structures can be defined as

cylindrical, disordered, plate-like, or narrow slit-like in nature [20-22].

Practically, the surface area and pore size information can be used to help select the appropriate amount and type of dispersant for wetting a pigment agglomerate. For example, as the surface area and porosity increases (analogous to increased oil absorption) a larger amount of dispersant is required, when compared to that of another pigment with comparatively lower surface area. As the pore structure of each agglomerate changes, the effectiveness of dispersing agents will also change. An agglomerate with a narrow slit-like pore structure may not accommodate a high molecular weight dispersant in the same way that an agglomerate containing larger cylindrical pores will. In such an instance, the wetting/dispersing agent will take longer to become effective (increasing production time), or prevent the development of the pigment to its full strength (requiring more pigment than what is potentially necessary).

Once wetted, the agglomerates need to be distributed through the application of mechanical energy. Distribution takes place in the presence of pigments, additives, dispersants, wetting agents, and/or resin particles that are subjected to shear via high intensity mixing, tumbling, kneading, or extrusion. The mechanism and methods regarding physical dispersion is well referenced and studied and therefore is not included herein [1].

Conclusion

Organic pigments are highly complex combinations of chromophores and auxochromes. In their powdered form, pigments consist of an assemblage of particles that are held together by strong chemical and physical forces forming agglomerates. The nature and strength by which agglomerates form are unique and can be caused by processing/refining technique, particle size, particle shape, morphology, and inherent chemistry. The effect of dispersing aids or wetting agents will depend on knowledge of the surface area, porosity, surface charge, and reactivity of each unique pigment chemistry in order to optimize coloristic properties.

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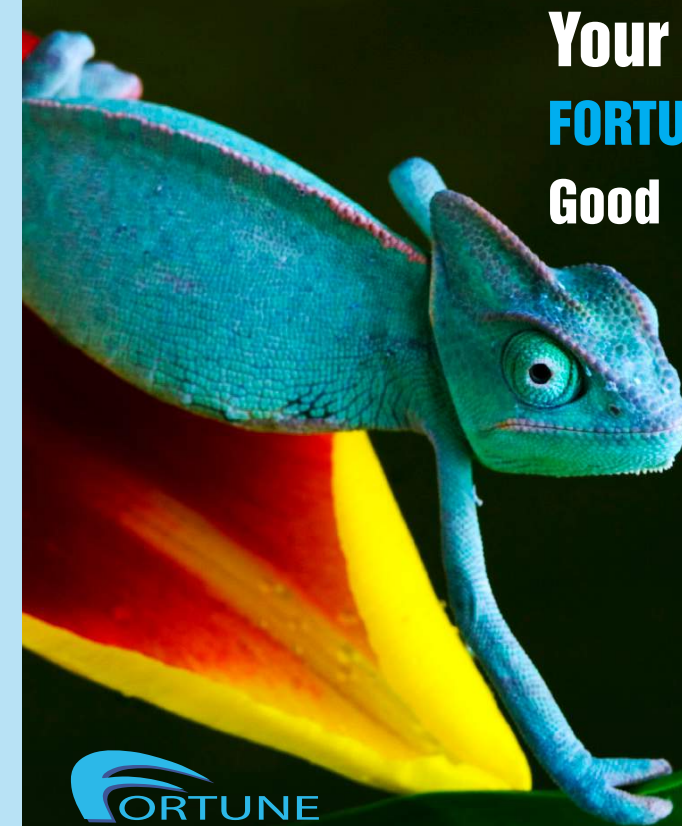
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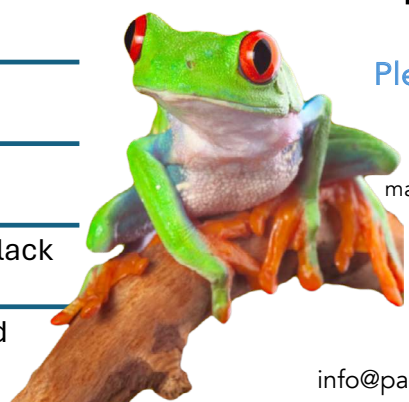
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