FALL 2026

SOCIETY OF PLASTICS ENGINEERS

CADNEWS

RETEC PROGRAM

TECHNICAL ARTICLE

PIGMENT DISPERSION QUALITY ASSESSMENT AND APPLICATION DRIVEN SPECIFICATIONS

COLOR AND APPEARANCE DIVISION

COLORING THE WORLD OF PLASTICS

CHAIRMAN'S MESSAGE

Hello and welcome to September and the 2026 Fall edition of CADNEWS®!

I am grateful and honored to serve as the 2026–2027 Chairperson of the Color and Appearance Division and to have the opportunity to work alongside the outstanding group of volunteers who make up our Board of Directors.

First, I would like to recognize and thank Kimberly Williamson for an excellent year as our Chairperson. Kim did an exceptional job leading the division, and we greatly appreciate her tireless service and dedication throughout the years. I would also like to thank all of our past chairs for their leadership and contributions to CAD. I look forward to continuing the tradition of success they have established.

In addition, the CAD Board is pleased to welcome three newly elected members—Kelly White, Lori de la Cruz, and Bonnie Pirro—who will each serve a three-year term. We are excited to have them join the Board and look forward to their contributions to the division.

As the summer months have flown by, our CAD Board members have been busy preparing for this year's RETEC®, "Where Color Leads the Field," being held at the Omni Hotel in Louisville, Kentucky, September 13–15, 2026. Bruce Mulholland, our RETEC team, and I have been working hard to ensure another successful conference. We have put together an excellent technical program, along with a new schedule designed to provide attendees with more opportunities for networking, meetings, and engagement in the exhibit hall. I hope to see you there!

A big "Thank You" goes to all of our sponsors for this year's RETEC. Their continued support makes it possible for us to host our annual conference, provide valuable technical education, award scholarships to college students, and continue our support of SPE Plastivan, which helps educate and inspire the next generation of our industry. Please take the time to visit our sponsors' links and learn more about the companies that make these programs possible.

I would also be remiss if I did not recognize the companies that support each of us in our involvement with CAD—from serving on the Board of Directors and our committees to participating in RETEC. Collaboration and education are essential to the continued success of our division and our industry, and we greatly appreciate the companies that recognize the value of supporting these efforts.

In closing, I am excited about the year ahead and look forward to working with this dedicated group of volunteers as CAD Chair. We have a tremendous opportunity to continue building on the division's strong foundation while finding new ways to provide value to our members and the plastics industry.

Please do not hesitate to contact me with any comments, ideas, or suggestions for the Color and Appearance Division. I look forward to a productive year and, most importantly, I look forward to seeing you in Louisville for RETEC®!

TJ STUBBS
Color and Appearance Division
2026 / 2027 Chairperson

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WE'D LIKE TO SAY A SPECIAL THANK YOU TO THESE GENEROUS SPONSORS AND RECOGNIZE THEIR SUPPORT OF THE CONFERENCE.

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EVENTS

LANYARDS
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WELCOME RECEPTION
Sponsored by: Trust Chem USA

Olmstead 1-4, 2nd Floor

Sunday, September 13th | 8:00pm – 11:00pm

Join us for cocktails, networking, light snacks & surprises

Complimentary with Registration
No drink tickets needed!

EXHIBIT SCHEDULE

COMMONWEALTH 4-8

Monday, Sep 14th | 10:00 am to 5:00 pm

Tuesday, Sep 15th | 9:00 am to 3:30 pm
(closed during lunch)

MONDAY BREAKFAST
Sponsored by: Shepherd Color

Olmstead 5-7

Monday, September 14TH | 7:00am– 8:00am

Complimentary with Registration

TUESDAY BREAKFAST
Sponsored by: Liberty

Olmstead 5-7

Tuesday, September 15TH
8:00am – 9:00am

Complimentary with Registration!

CONFERENCE INTERNET ACCESS
sponsored by royce global
PASSWORD: ROYCE2026

CAD SURVEY RAFFLE

Commonwealth 1-3

Tuesday, September 15TH
4:30pm

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: CAD

Olmstead 1-4

Tuesday, September 15TH | 12:00pm – 1:30pm

Complimentary with Registration!

5K FUN RUN / WALK
Sponsored by: Chroma Specialty Chemicals

TO BENEFIT PBSF DOG RESCUE OF LOUISVILLE

Tuesday, September 15TH | 7:00am in the Hotel Lobby

Start your morning off right. Join us bright and early for a fun run/walk around the local area.
You will be back in time to enjoy breakfast.

FREE T-SHIRT FOR THE RUNNERS

COST
$25
CAD will match your donation

PLASTIVAN AT CAD RETEC®

CLIFTON ROOM

Tuesday, September 15TH

9:00am	Students Arrive
9:15am	View RETEC® tabletops
10:00am	PlastiVan Session
12:00pm	Students Depart

MULTI-VENDOR HOSPITALITY SUITE

Sponsored by:
Chroma Specialty Chemicals,
LANXESS, Sudarshan,
Sun Chemical, Vivify

Olmstead Pre-Function

Monday, September 14TH
9:00pm – 11:00pm

GET THE SPE EVENT APP

1.Download the app from your app store (Android or iOS) using the QR code or find the app Swapcard – Smart Event App
2.Enter your e-mail address used to register for RETEC
3.Set up your password or click the “Send me a magic link”
4.Select the “SPE-Inspiring Plastics Professionals” organization
5.Select “SPE Color & Appearance Conference 2026”
NOTE: Paper downloads are available on the mobile app this year.

CAD RETEC® 2026

Technical Program

Monday, September 14, 2026

Commonwealth 1-3

Moderator	Tony Tanner	*Trust Chem USA*
7:55 AM	**Opening Remarks**	TJ Stubbs, *Teknor Apex*
8:00 AM	**Keynote: Appearances Aren't Deceiving: PLASTICS and SPE Look Good**	Patrick Krieger, *PLASTICS*
8:30 AM	**Emerging Color, Material and Finish Directions for 2028**	Mercedes Landazuri, *Ampacet*
9:00 PM	**New Technology Forum (see separate schedule)**	Tony Tanner – Moderator
10:00 AM	**Break (Commonwealth 4-8)**	Sponsored by Susonity
11:00 AM	**Expanding Role of Heat-Management Pigments in High-Performance Technologies**	Breeze Briggs, *Sun Chemical*
11:30 AM	**Solvent Dyes in Plastics: Performance, Processing, and Regulatory Considerations**	Bonnie Piro, *Sudarshan*
12:00 PM	**Lunch on your own**	
Moderator	Christine Gehres	*Coaching With Passion*
1:30 PM	**Something old, something new, something borrowed, and two things Blue: Updates on recent inorganic pigment advances**	Mark Ryan, *Shepherd Color*
2:00 PM	**High-Tech Dyes for Plastics and New Mobility**	Ann Seltzer, *LANXESS*
2:30 PM	**Updates on the Regulation of Chemicals in Food Packaging**	Kelsey Anlicker, *Keller & Heckman*
3:00 PM	**Color at the Crossroads: Navigating the Policy Landscape of the Color Value Chain**	Robby Helminiak, *CPMA*
3:30 PM	**Break (Commonwealth 4-8)**	Sponsored by Vivify
3:30 PM to 5:00 PM	**EXHIBITS OPEN**	

CAD RETEC® 2026

Technical Program

Tuesday, September 15, 2026

Commonwealth 1-3

Moderator	Bonnie Piro	*Sudarshan North America*
8:55 AM	**Welcome Day 2**	TJ Stubbs, *Teknor Apex*
9:00 AM	**Sustainability Update for Colors & Effects in Plastics**	Doreen Becker, *Ampacet*
9:30 AM	**Green today, Red tomorrow? A traffic-light framework for regulatory-resilient substitution**	John Howard, *Tronox*
10:00 AM	**Break (Commonwealth 4-8)**	Sponsored by Tomatec
11:00 AM	**CIELAB at 50**	John Seymour, *John the Math Guy*
11:30 AM	**Why D65 Spectral Fidelity Matters in Industrial Spectrophotometry**	Jack Ladson, *Color Science Consultancy*
12:00 PM	**Awards Lunch (Olmstead 1-4)**	Sponsored by CAD
Moderator	Kelly White	*Omya Inc*
1:30 PM	**Additives for durable, fast and accurate laser marking silicones**	Kevin Lucero, *Susonity*
2:00 PM	**Maintaining clarity, smoothness, printing, labelling and hot-sealing properties while using an FDA-approved, PFAS-free PPA to eliminate sharkskin in LLDPE films.**	Frank Neuber, *Clariant*
2:30 PM	**The Influence of Carbon Black on Dye Photodegradation in Polymer Coloration Systems**	Doug Koerner, *Paramount Colors*
3:00 PM	**Break (Commonwealth 4-8)**	Sponsored by Silver Sponsors
3:30 PM	**Color Compounding with Co-Rotating Twin Screw Extruders**	Ed Gay, *Krauss Maffei*
4:00 PM	**Innovative Color Compounding applied to a renewable pigment. A Collaborative Approach to Circular Plastics**	Dean Elliott, *Entek* Philip Brunner, *BioRegion Tech*
4:30 PM	**Closing Remarks & Raffle (must be present to win!)**	TJ Stubbs, *Teknor Apex*
5:00 PM	**Conference Ends**	

SEE YOU NEXT YEAR IN CHARLOTTE, NC!

CAD RETEC® 2026 TABLETOP EXHIBITORS

Company	No.	Company	No.
3V Sigma USA	209	Paramount Colors Inc.	201
Ampacet Corporation	502	Plastics Industry Association	510
Azelis Americas	403	Prime Materials	506
Brilliant Group Inc.	412	Q-LAB Corporation	410
Buckeye Color	407	Royce Global	308
Chemours	311	Sincol North America	309
Chroma Specialty Chemicals	405	Society of Plastics Engineers	512
CINIC America	207	Spectra Dyestuff Inc.	305
Color Pigments Manufacturers Association	409	Sudarshan North America	107
Colosperse Dyes and Intermediates	504	Sun Chemical	102
Datacolor	103	Superior Minerals Solutions	508
Day Glo Color Corporation	202	Susonity	111
DCL Corporation	112	Tempo Chemicals & Solutions	408
Eckart America	105	The Shepherd Color Company	108
Entek International LLC	411	Tomatec	208
First Source Worldwide LLC	310	Torrecid USA	302
Fortune International Technology	406	Trust Chem USA, LLC	301
H.L. Blachford Ltd.	212	United Mineral and Chemical Corporation	101
KeyColour Synthesis	404	Vibrantz Technologies	204
Leistritz Extrusion	106	Vivify Company	306
Liberty Specialty Chemicals	307	Yipin USA	210
Milliken & Company	206		
MIXACO USA	402		
OXERRA Americas, Inc.	401		

NEW TECHNOLOGY FORUM

Commonwealth 1-3 | 9:00AM | Monday, Sep 14th

Don't miss the chance to hear about new offerings from these exhibitors.

See schedule below. Moderated by Tony Tanner, Trust Chem USA

#1	Chroma Specialty Chemicals
#2	Trust Chem USA
#3	3V Sigma USA
#4	Sudarshan North America
#5	Susonity

#6	Q-Lab Corporation
#7	Sun Chemical
#8	Torrecid USA
#9	The Shepherd Color Company
#10	Paramount Colors Inc.

CHARLOTTE, NC

CAD RETEC 2027

WHERE COLOR MEETS ROYALTY

CAD RETEC® 2027

CALL FOR PAPERS

Sheraton & Le Méridien
Charlotte, NC
September 20 – 22, 2027
(Monday, Tuesday, Wednesday format)

Deadline for Abstracts is February 2027

Chairperson: Tony Tanner, Trust Chem USA
tony@trustchemusa.com

Vice-Chairperson: Steve Esker, Paramount Colors
steve@paramountcolors.com

Technical Program: Doreen Becker, Ampacet
doreen.becker@ampacet.com

Karen Carlson, Susonity
karen.carlson@susonity.com

Color and Appearance Division

spe COLOR & APPEARANCE

Call for Candidates

Color & Appearance Division
Board of Directors

WE NEED YOUR HELP – CONTINUE THE EXCELLENCE!

- Interested candidates for the 2027 Board of Directors should contact Tony Tanner or any Board Member, or indicate your interest on the questionnaire
- We will be soliciting candidates through the end of 2026
- Biographies due February 2027
- Elections will be conducted in Spring 2027
- If elected, term is 3 years (serve until 2030)
- 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

Society of Plastics Engineers
Color & Appearance Division
Endowment Scholarship Program
for the 2027 – 2028 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 $8,000 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 2027. 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@sudarshan.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.

CAD RETEC® 2026 COMMITTEE

Chairperson	TJ Stubbs	*Teknor Apex*
Vice-chairperson	Bruce Mulholland	*Celanese (retired)*
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	Mercedes Landazuri	*Ampacet*
Technical Program	Mark Ryan	*The Shepherd Color Company*
	Alex Prosapio	*Sudarshan*
New Technology Forum	Tony Tanner	*Trust Chem*
Moderators	Brian Coleman	*Ampacet*
Exhibitors	Kimberly Williamson	*Techmer PM*
Registration	Bruce Mulholland	*Celanese (retired)*
Sponsorship	Michele Claeson	*Trust Chem*
	Alex Prosapio	*Sudarshan*
Technical Content Review	Mark Ryan	*The Shepherd Color Company*
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	Brian Coleman	*Ampacet*
Golf Outing	Mark Tyler	*Tempo Chemicals*
Raffle	Mike Manley	*Holland Colours*

TECHNICAL ARTICLE INTRODUCTION

CADNEWS TECHNICAL CONTENT

The Technical Content portion of this edition of CADNEWS® includes a paper presented during the recent RETEC. The paper by Fang Wang, Colors & Effects, Sun Chemical, PIGMENT DISPERSION QUALITY ASSESSMENT AND APPLICATION DRIVEN SPECIFICATIONS. This paper focuses on the pigment dispersion quality evaluation and product line specification for dispersion demanding processes such as thin film, fine denier textile fiber and nonwoven fiber using the FPV test DIN EN 13900-5.
Take a moment to read and as always if you have any questions you can ask any questions using the Color Notes Link below.

CADNEWS COLOR NOTES

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/

TECHNICAL ARTICLE

PIGMENT DISPERSION QUALITY ASSESSMENT AND APPLICATION DRIVEN SPECIFICATIONS

Fang Wang, Colors & Effects, Sun Chemical, Southfield, MI 48034

Abstract

The focus of this paper on the pigment dispersion quality evaluation and product line specification for dispersion demanding processes such as thin film, fine denier textile fiber and nonwoven fiber using the FPV test DIN EN 13900-5. It began with the highlight of the importance of dispersion quality and followed by a general review of pigment attributes and how these impact pigment properties relevant to plastics applications. The FPV test is then discussed, and the nominal particle retention size of filter screen is reviewed to show that the 25 µm screen FPV < 1.0 or 2.0 bar/g specification for pigments in dispersion critical applications no longer provides enough differentiation for today's demanding market. Smaller screens were tested on a board spectrum of pigment products and showed progressively more differentiation of pigment dispersion quality. It is proposed to move the long running 'fiber grade' pigment specification to 14 µm FPV < 1.0 bar/g, and further lot selection on 5 µm FPV < 3.0 bar/g for the most demanding processes.

Introduction

Pigments that are successful in plastics applications meet several requirements. The main requirements can be categorized as polymer suitability, process requirements, performance needs, regulatory compliances, coloration fulfilment, and value in use.

We will review these requirements and direct our focus on the pigment dispersion topic. Powder pigments in aggregates and agglomerates form need to be dispersed for their intended applications. Achieving a quality pigment dispersion is important for plastics coloration goals:

1. Efficiency in dispersion demanding product processes, such as blown films and fibers extrusion.
2. Optimal physical appearance and lack of defects like specks and streaks.
3. Mechanical properties. For example, many plastic parts need to have certain impact strength, while other plastic construction may be pressurized. The defects in polymer matrix caused by poor dispersion can compromise such physical properties.
4. Reproducible color results.
5. Good economics.

To enable these, the pigment manufactures, and their plastics application customers have invested tremendous resources to develop, optimize dispersion formulation and processes, and quality assurance methods. These evolve continuously with the advancement of manufacturing technology, testing capability, market demand, and customer expectations.

One critical pigment dispersion quality test for plastics application is the Filter Pressure Value (FPV), Delta P, pressure rise, pack blind, or filter screen test. We will examine the dispersion, measurements, and their utility.

Review of Pigments and Their Performance

Pigments are insoluble solid materials that are used to give color to or improve the appearance of a medium.

Pigments for plastics applications need to meet requirements such as polymer suitability, process requirements, performance needs, product safety & regulatory compliances, coloration fulfilment, and value in use.

Relevant pigment properties to plastics application requirements include heat resistance, chemical resistance, light fastness, weather fastness, opacity or transparency, crystal stability, dispersibility, rheology, gloss, warping, color strength and hue angle. These are influenced by their chemistry, crystal structure, and surface properties.

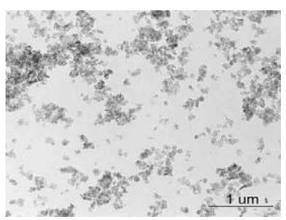
Based on their chemistry, pigments are divided into organic pigments and inorganic pigments. Organic pigments are based on carbon chains and rings, and mainly manufactured from aromatic hydrocarbons like petrochemicals and coal tars. Inorganic pigments are usually metal and metallic salts. They are generally more opaque, more insoluble, and have better fastness properties than organic pigments.

Chemical structure determines how the pigments generally perform in the applications. Pigments with excellent heat resistance, weather resistance, and low concentration suitability are classified as high performance pigment (HPP), while ones with good enough heat stability, poor weather fastness, and not recommended at low concentrations are known as classic pigment. Notable HPP chemistry includes isoindolinone, quinophthalone, perylene, quinacridone, and indanthrone.

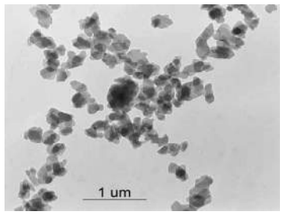
Pigment surface chemistry can impact important process and application attributes such as dispersion, rheology, gloss, and warping.

Crystal structure and primary particle size can influence pigment performance to certain extent. Pigment primary particle sizes are on submicron level for inks, coatings, and plastics applications. One HPP workhorse red pigment, Diketo-pyrrolo-pyrrole (DPP) chemistry is an example that crystal size can have pronounced impact on performance of the pigment. When DPP crystals are on the tens of nanometer scale, these yellowish red pigments are highly transparent and low on fastness properties. With the increase of particle size, DPP become less transparent and higher in performance. At the hundreds of nanometers in particle size, these pigments are semi opaque and high performance. Figure 1 illustrates the particle size variability of PR 254. Due to this and many other important characteristics not discussed in this paper, we should remind ourselves that the same Color Index does not equate the same product!

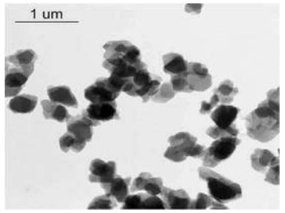
Figure 1. Particle Size and Efficacy of Pigment Red 254



PR 254 Sample A
High transparent
Lowest performance



PR 254 Sample B
Semi opaque
High performance



PR 254 Sample C
Semi opaque
Highest performance

In coloration of plastics materials with pigments, dispersing the pigment to breakdown the agglomerates followed by the quality check is generally the first step. The dispersion process is usually customized for the intended applications and associated requirements.

Although the current circumstances are far more complex than ever in product safety and regulatory compliance, performance requirements that evolve with the continuous innovation of new polymers and new applications, and myriad puzzle pieces in raw materials, supply chain, and logistics, the pigment evaluation methodology has remained to be the rock.

When evaluating and comparing pigments for plastics application, dispersion quality and color are the first two properties to examine. These results coupled with cost guide initial value-in-use assessment. The information enables most of the evaluation and comparison to conclude at this early stage. Such simple methodology, often used informally, has been efficient and effective in various decision-making processes for both pigment manufactures and their customers.

Pigment Dispersion and Evaluation

Measurement of dispersion

Dispersity of a pigment and dispersion quality of pigment(s) in a polymer matrix can be measured by a variety of methods. Some examples are direct visual or microscopic examination of thin films for specks or inclusions; measurement of sample tinting strength vs. a standard; and DIN EN 13900-5, “Pigments and extenders – Methods of dispersion and assessment of dispersibility in plastics – Part 5: Determination by filter pressure value test.”, which is referred as the FPV test in some of the subsequent discussions.

The FPV test and filter screens

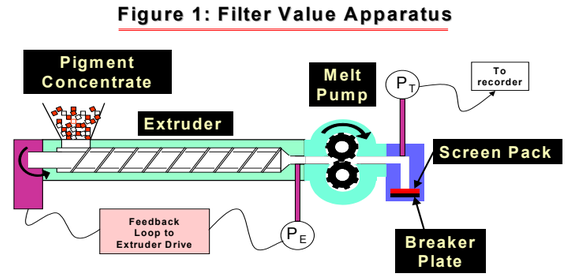
DIN 13900-5 was publishes in late 2004. It was adopted gradually in the world and has become the standard test for the dispersion evaluation and communication. The test equipment and associated supplies have been enjoying ever increasing demand as a result!

The FPV test specifies a method for the assessment of the quality or extend of a pigment’s dispersion, it does not detail the manner in which the dispersion is achieved. It is often employed as a quality control measure for pre-dispersed color concentrates. Another use of the method is comparison of the pigments from different suppliers and manufacturing process when the primary dispersion step emphasizes pigment wetting over aggregate breakdown and is applied uniformly to a range of pigments. This test is also commonly used to develop the primary dispersion process and formulations.

The FPV test specifies key testing parameters for common language in reporting dispersibility: extrusion parameters, concentrations of pigment, and configurations of the critical screen packs and screen-holding apparatus, which is seen in Figure 2. The extend of pigment dispersion is reported as a pressure rise in bars rise per gram of pigment (FPV). For the past 20 years, low FPV, for example less than 1.0 to 2.0 bar/g of pigment through a nominal 25 µm screen, have been preferred for critical applications such as fibers, films or slit tapes. These pigment products are commonly known as ‘the fiber grade’. The key players in the pigment industry introduced such specified premium product lines to standardized specifications and product offerings for dispersion critical applications. The 25 µm screen-pack FPV provided adequate differentiation throughout the growth and mature of the US carpet fiber industry.

The rise of even more demanding markets and applications in more saturated or chromatic thinner film, finer denier textile fiber, and nonwoven fiber further raise ‘bar’ on dispersion quality in recent years. The color dispersion houses first responded to this rising demand and pioneered more critical check for dispersion quality on finer screen packs. Pigment manufactures gradually responded to this market demand. Many pigment selection and dispersion qualification are tested on finer screen packs not specified in the test method.

Figure 2. Filter Value Apparatus

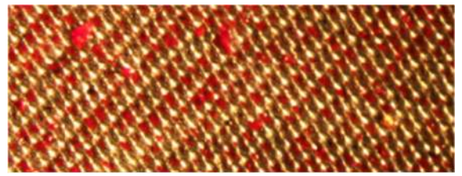


DIN EN 13900-5 lists three types of filters and allows for the use of further finer screen-packs per applications demand. In addition to Screen-pack 1, Screen-pack 2 and Screen-pack 3 nomenclatures, they are also commonly referred by their nominal opening sizes, 25, 14, and 10 µm, respectively. As a side note, mesh size nomenclature finds more utility describing larger openings, such as the screens used in polymer filtration.

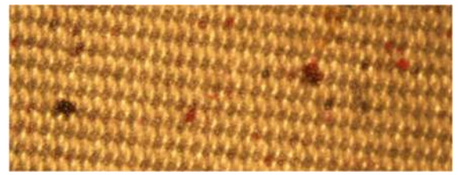
Currently, the FPV values on a 14, 10 or 5 µm screen-pack, latter not listed in the method, is routine and used commonly in the dispersion evaluation for dispersion demanding applications, such as some film, nonwoven and fine denier textile fibers.

Figure 3 shows the 5 µm FPV screens of two different PR 202 products, a versatile HPP blue shade red in quinacridone chemistry, dispersed with the same formulation and process that show large difference in dispersibility. The color strength difference of these two pigments is shown in Figure 4.

Figure 3. Microscopy of Pigment Red 202 Dispersion Quality on 5 µm Filter Screen



PR 202 Sample D
High FPV



PR 202 Sample E
Low FPV

Figure 4. Microscopy of Pigment Red 202 Dispersion Quality and Color Strength in Fibers

PR 202 Sample D
Lower color strength

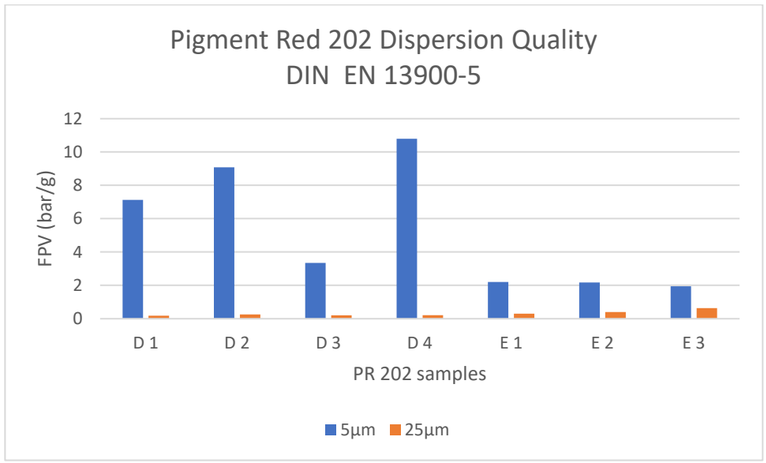
PR 202 Sample E
High color strength

Differentiation of dispersion quality on different size screen-packs

In more recent years, we received field report occasionally that some lots of the 25 µm FPV specified pigments do not meet their dispersion needs. When similar feedback came from customers in different regions, we began our journey in the examination of pigment dispersion quality evaluation. We asked ourselves if our specification still meet current market needs, if new specifications are needed for more dispersion critical applications such as thin film, fine denier textile and nonwoven fibers, how we can improve and grow our technical capabilities to better meet and anticipate market demand. Our lab ran an initial screen size/type in dispersion quality check. This work quickly snowballed and provided insightful results.

In short, in some cases, the 25 µm FPV test does not provide enough differentiation and smaller screens 14, 10 or 5 µm needed. This is what we observed in Pigment Red 202. The two PR 202 products in Figure 3 meet the 25 µm specification (FPV = 0.2 and 0.3 bar/g respectively). Multiple samples of each pigment were collected, dispersed, and tested under the same conditions. The results are shown in Figure 5. It is evident that 5 µm FPV test provided quality differentiation while the 25 µm FPV test did not.

Figure 5. FPV Differentiation of the Dispersion Quality of Pigment Red 202 Products



Additional Results and Discussion

In order to generating meaningful results, a methodical pathway is laid out and followed through. We first investigated dispersion methods; then performed Round Robin FPV test in our labs in different regions; lastly, we tested commonly recommended pigments for major polymers in films and fibers applications.

Dispersion method

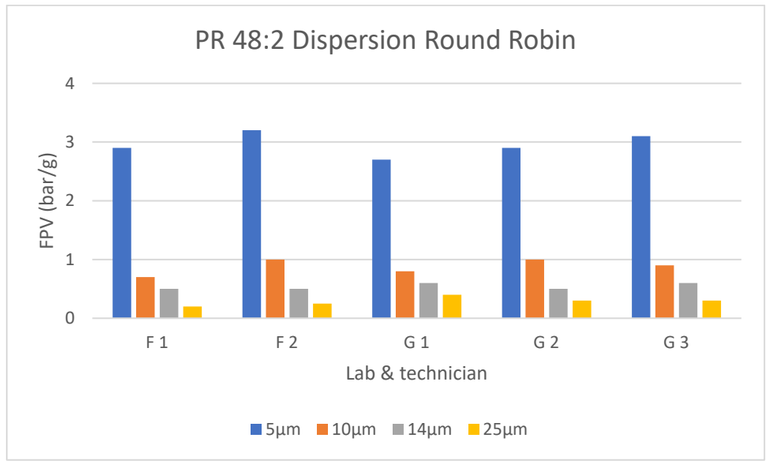
Dispersion methods fall into two general categories: predispersion and direct compounding. Specific dispersion formulation and process is proprietary for each pigment dispersion business. Our lab test results confirmed our expectation that direct compounding method is not suitable for us in this study because of the seemingly unlimited variables in extruders and extrusion parameters. On the other hand, the predispersion method is approved to be rather precise.

We selected a reliable and robust wax method, using a readily available PE wax and a generic high speed mixer. The wax is in fine powder form and high loading to ensure adequate wetting for all pigments in the consideration.

Round Robin FPV test

One pigment from each color family was selected. Adequate sample quantities were secured to homogenize, divide up, and sent to each lab. Each chemist or technician then prepared his/her own pigment dispersion and independently tested per DIN (EN) 13900-5 on four types of screen packs, 25, 14, 10 and 5 µm screens from two different suppliers. Figure 6 is one example of the dispersion test results of a classic red PR 48:2 for polyolefin in various applications. The test was performed by five coworkers in two labs. All other results also show similar good agreement.

Figure 6. FPV Round Robin test

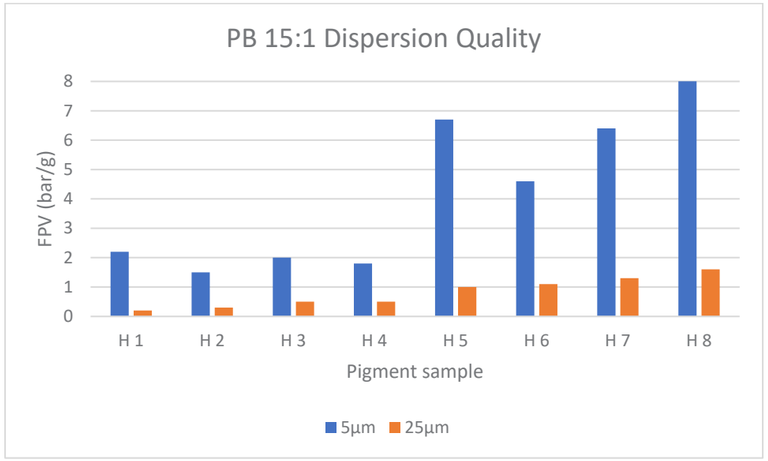


FPV results and discussion

The majority well-known fiber and film grade pigments, both organic and inorganic, were tested on 25, 14, 10 and 5 µm screens. The Color Index of pigments in this study include: PB 15:1, PB 15:3, PG 7, PR 48:2, PR 48:3, PR 57:1, PR 144, PR 214, PR 122, PR 202, PV 19, PY 93, PY 95, PY 110, PY 128, PY 139, PY 155, PY 191:1, PBr 24, PBr 29, PB 28, PR 101, PY 164, PG 50 from various manufacturing processes.

Like the examples seen so far, test results indicated that 25 µm FPV appear not providing enough differentiation in pigment dispersion quality for some critical application. Fiber and film grade product recommendation should move to a smaller screen, like 14 µm. Most critical applications can adopt a 5 µm FPV lot selection scheme. Figure 7 shows PB 15:1, a key workhorse phthalocyanine blue pigment in red shade blue space has much higher differentiation on a 5 µm filter screen than on a 25 µm screen pack.

Figure 7. Pigment Blue 15:1 FPV Test Results



In preparation for specification change: case study and customer validation

As discussed earlier in the paper, several customers reported that fiber grade pigments specified at 25 µm FPV < 1.0 or 2.0 bar/g sometimes did not fulfill their quality needs in their application. In conjunction with this study, we partner with these customers in determination and validation of more relevant product specification and lot selection plan.

The proposal is to move film and fiber grade product specification to 14 µm FPV < 1.0 bar/g. For the most critical needs, lot selection sets at 5 µm FPV < 3.0 bar/g.

Conclusion

In conclusion, we discussed pigment dispersion for intended plastics applications, dispersion quality evaluation method, role of the filter screen, and proposal to upgrade fiber grade pigment product specification to meet current market needs.

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1. Coloring of Plastics, Fundamentals, 2nd Ed., Edited by R. A. Charvat, Wiley Inter-Science (2004)
2. DIN EN 13900-5, "Pigments and extenders – Methods of dispersion and assessment of dispersibility in plastics – Part 5: Determination by filter pressure value test."

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