

2021 EVENT PROGRAM



**Cable & Connectivity
Industry Forum™**

by **IWCS**

VIRTUAL | OCTOBER 4–8, 2021

INDUSTRY LEADERSHIP • INNOVATION • PROFESSIONAL DEVELOPMENT

IWCS



Register at
iwcs.org/register

70 YEARS

IWCS**WELCOMES YOU!**

WELCOME TO THE 70TH ANNUAL IWCS EVENT!

In this unprecedented and challenging year for all of us, your health and well-being is always our most important consideration, which is why we are holding the IWCS 2021 Cable & Connectivity Industry Forum virtually. Our thoughts and prayers remain with all of the victims of this virus and hope that you continue to stay safe and take all precautions to protect your family, friends and neighbors!

The virtual event platform has been enhanced to deliver an even more exciting, interactive, and user-friendly experience that features all elements of our traditional in-person event, and more! Attendees, presenters, and exhibitors from all around the world can use the intuitive and interactive event platform to experience the same level of education, thought leadership, and networking that's delivered at in-person events. The event schedule was carefully crafted to accommodate as many time zones from around the world as possible. You will be able to add your desired sessions and event activities to a personalized agenda and after the event concludes, registered attendees will also be able to access the presentations and Supplier Exhibition "on-demand" through November 14, 2021. So, you won't miss a thing, regardless of where you are!

IWCS is proud of its strong 70-year history and is dedicated to maintaining the premier technology forum for the exchange of information about product, material and process innovation for cabling and connectivity solutions. The vitality of IWCS is demonstrated by the strong support coming from our industry-leading sponsors and exhibitors in our Supplier Exhibition! With this support, IWCS is able to not only host this event, but also award scholarships, publish important technical papers, and help to develop scholars and industry professionals.

We recognize that networking is a critical element of any industry gathering, and we plan for plenty of opportunities during the IWCS 2021 virtual event. For fun, we will once again provide games and incentives for you to win valuable door prizes simply by visiting the virtual sessions and Exhibition Booths.

Thank you, for joining us this unique IWCS 2021 Virtual event! We want to meet all of your expectations for a valuable learning and networking experience. We look forward to meeting you and hearing of any suggestions you have to further improve your IWCS Conference in the years to come! With perseverance and confidence, we hope to see you in-person at IWCS 2022 in Providence, Rhode Island, USA!

REGISTRATION

Registration will be held online prior to and during the event: iwcs.org/register

You are encouraged to register at least two weeks prior to the IWCS 2021 Virtual Cable & Connectivity Industry Forum so that you can explore and familiarize yourself with the virtual platform and set up your Profile in advance to maximize your Networking capability.

USE THE HASHTAG #IWCS2021 TO BE FEATURED ON THE NETWORKING SOCIAL WALL AT THE EVENT!



WIN PRIZES THROUGH INTERACTIVE NETWORKING OPPORTUNITIES

Once you are logged into the event platform, discover how to win prizes by visiting the "Game" room located at iwcs2021.pathable.co/game.

Examples of how to collect points and win prizes include:

Join a virtual trade show live meeting	Watch a video in an Exhibition booth	Post a photo on the discussion board
Watch a webinar	Download a file from an Exhibitor	Post a message on the discussion board
Participate in a poll	Accept a private meeting	Add a session to your agenda
Leave your card with an Exhibitor	Request private meeting	Send a private message



**Cable & Connectivity
Industry Forum™**
by **IWCS**

Save the Dates for IWCS 2022!

With perseverance and confidence, we hope to see you in person next year.

Monday – Thursday, October 10 – 13, 2022 | Providence, Rhode Island, USA



TECHNICAL SYMPOSIUM | Open to everyone with **Full-Access** registration

Your IWCS Symposium Committee has generated an extremely high-caliber program for the IWCS Technical Symposium, the cornerstone of the Cable & Connectivity Industry Forum. The IWCS Technical Symposium is recognized around the world as the premier technology event for cable and connectivity. In our 70th year, we will present over 75 previously unpublished Technical Papers featuring research and development for cabling and connector / interconnect technologies, designs, components, materials, fabrication, performance, testing and applications. Sessions will begin on Tuesday October 5th with Sessions running simultaneously through Friday, October 8th. Each Technical Session presentation will also be available “on-demand” through November 12th.



PLENARY SESSION WITH KEYNOTE | Open to everyone with **Full-Access** registration

Promising to be a highlight of the 2021 Conference, the annual Plenary Keynote presentation will kick off the first day of the Forum on Monday, October 4th. The Keynote features an intriguing perspective on the trends and drivers for our cable and connectivity industry. During the Plenary Session, we will also recognize the best papers and presenters from last year’s event.



EXECUTIVE SESSION | Open to everyone with **Full-Access** registration

Also taking place on Monday, the Executive Session is designed for the general management of the cable & connectivity producing companies and their suppliers. Important issues and economic trends facing the industry in these uncertain times will be addressed by expert speakers, followed by a fascinating panel of industry CTO’s and leaders. You will not want to miss this provocative and insightful session! The Plenary and Executive Sessions are open to all registered Technical Symposium attendees.



ROUNDTABLE DISCUSSIONS **New this year!** | Open to everyone with **Full-Access** registration

The IWCS 2021 Cable & Connectivity Forum will feature three roundtable discussions presented by influential industry leaders. These discussions feature important topics about the cable & connectivity industry’s impact on community evolution, building a more sustainable future, and protecting our communities from serious threats. These roundtables are sponsored by Dow, UL, and Covestro.



PROFESSIONAL DEVELOPMENT COURSES | Open to everyone who registered for **Professional Development Courses**

This year, IWCS will present the annual core courses of Copper 101, Fiber 101, Materials 101 and Extrusion 101 through our live, virtual platform. Participants receive real-time education from our experienced instructors in our video classrooms, allowing participants and instructors to engage in conversation, ask questions and download files on demand from the comfort of your own office. The four core courses will provide those new to our cable & connectivity industry with basic technology information.



SUPPLIER EXHIBITION™ | Open to everyone with **Full-Access** or **Supplier Exhibition Only** registration

The IWCS Supplier Exhibition will include virtual booths providing interaction among various levels of the Cable & Connectivity Supply Chain, to learn about the wide variety of product technologies and user applications. Also, Supplier Spotlight Presentations provide an opportunity for you to learn about the industry’s latest product innovations and services. These presentations will take place during the dedicated Supplier Exhibition on Monday–Thursday.

Virtual Exhibition Booths are open before (starting September 29), during (October 4–8), and after (through November 12) the event. You are encouraged to visit booths at any time to engage with content exhibitors have on display. Supplier Exhibition booth staff is encouraged to be available for live 1-on-1 video calls during the following dedicated supplier exhibition hours. Additionally, may chat with suppliers outside of these dedicated hours by typing a chat message in their booth or scheduling a private meeting directly through the event platform.

Dedicated Supplier Exhibition Hours	Monday, October 4	2:00 pm–4:00 pm	Supplier Exhibition & Supplier Spotlight Presentations
	Tuesday, October 5	8:30 am–10:00 am	Supplier Exhibition & Supplier Spotlight Presentations
	Wednesday, October 6	2:00 pm–4:00 pm	Supplier Exhibition & Supplier Spotlight Presentations

IWCS PHOTOGRAPHY POLICY

Attendance at, or participation in, this event constitutes consent to the use and distribution by IWCS of the attendee’s image or voice for informational, publicity, promotional, and/or reporting purposes in print or electronic communications media.

Video Recordings by participants/other attendees during any portion of the conference is NOT allowed without prior written permission of IWCS.

Photographs of copyrighted, confidential and/or proprietary PowerPoint or other Presentation Slides are not to be taken, reproduced or distributed. Do NOT copy any such images without prior permission of the Author / Presenter.

2021 ATTENDEE REGISTRATION FEES

Register at
iwcs.org/register

	AUGUST SPECIAL	ADVANCED	REGULAR
	Before August 27, 2021	August 28 through September 17	After September 17
ATTENDEE FULL-ACCESS (includes all Technical, Executive, and Plenary Sessions and Access to the Supplier Exhibition)			
Individual*	\$650	\$750	\$900
<i>10 pack: \$6,500 (\$2,500 savings!)</i>			
Speaker (One Per Paper)	\$450	\$450	\$800
Academic/Student*	\$25	\$25	\$25
PROFESSIONAL DEVELOPMENT COURSES			
One Course	\$510	\$510	\$560
Two Courses	\$680	\$680	\$875
VIRTUAL SUPPLIER EXHIBITION <i>Access to Virtual Supplier Exhibition Hall October 4–October 7, 2021</i>		\$50	

Notes:

1. Prices quoted in US Dollars
2. Companies participating in the 2021 Supplier Exhibition receive one complimentary Full-Access.
3. Cancellation: Conference or course cancellations must be received in writing by September 21, 2021 and are subject to a \$50 processing fee. After this date, no refunds are granted. However, substitutions are permitted.
4. VISA, MC & AMEX accepted. Credit Card payment requires a processing fee of US \$25.

Questions?

Email or call Michelle Melsop
mmelsop@iwcs.org
+1.571.265.3657





Eastern USA	Monday October 4	Tuesday October 5	Wednesday October 6	Thursday October 7	Friday October 8
8:30 AM – 9:00 AM	Session 1 Executive Session	Professional Development Course	Supplier Exhibition	Session 6 Optical Cable Installation & Network Management	Professional Development Course
9:00 AM – 9:30 AM		Professional Development Course			
9:30 AM – 10:00 AM	Materials MA101	Extrusion EX101			Session 5 Materials & Process Technology
10:00 AM – 10:30 AM					
10:30 AM – 11:00 AM	Executive Panel Session	Session 2 Connectivity: Innovation in Processing, Density & Deployment	Session 3 Emerging Optical & Cable Technologies		Professional Development Course
11:00 AM – 11:30 AM					
11:30 AM – 12:00 PM					Fiber Optic FO101
12:00 PM – 12:30 PM	Plenary Session with Awards		Coffee Break w/ Awards <i>Sponsored by: Teknor Apex</i>	Session 7 Optical Fiber Production & Characterization	
12:30 PM – 1:00 PM	Keynote Speaker		How to Guard Your Brand: Mitigating Risk of Non-Compliant Product Roundtable <i>Sponsored by: UL</i>		The Future of Community: How A Connected World Can Drive Innovation & Wellness, What Sustainable Technology ... Roundtable <i>Sponsored by: Covestro</i>
1:00 PM – 1:30 PM		Advancing Telecom Infrastructure: Material And Cable Innovation for A More Sustainable Future Roundtable <i>Sponsored by: Dow</i>			
1:30 PM – 2:00 PM		Music Break w/ Awards		"70 Year" Break w/ Awards	
2:00 PM – 2:30 PM	Supplier Exhibition	Session 2 Connectivity: Innovation in Processing, Density & Deployment	Supplier Exhibition	Session 8 Optical Fiber Splicing & Installation	Session 13 Flame Retardant Cable
2:30 PM – 3:00 PM					
3:00 PM – 3:30 PM					
3:30 PM – 4:00 PM					

Supplier Spotlight Presentations

The preliminary conference schedule may be modified as we near the event. View the most up-to-date schedule at iwcs.org.

PLENARY SESSION SPEAKERS

CEO AND CHAIRMEN



David B. Kiddoo
CEO/Director
IWCS, Inc.
Annandale, VA, USA



Dr. Scott H. Wasserman
Chair of the Board; IWCS, Inc.
Dow Wire & Cable
Collegeville, PA, USA



Dr. Brian Risch
Chair; IWCS 2021 Symposium Committee
Prysmian Group
Claremont, NC, USA

KEYNOTE SPEAKER

Connectivity Needs for our New Normal World: Network Evolution in the Cable and Connectivity Space

Abstract: As the world moves towards our new normal, we are more dependent on connectivity than we have ever been before. Every business is becoming more and more connected, every person is becoming more connected in more ways than they ever thought imaginable. The COVID-19 pandemic has put the entire world through a massive forced experiment around more ways to connect digitally, and much of what we have done out of necessity is likely to stay even as the world moves towards a new normal. The communications networks of today and tomorrow will be about connecting both people and machines, and providing a user experience that is more responsive and adaptable for the needs of the applications that provide value. This talk will discuss how these changes are affecting our society, and how cable and connectivity must evolve to support the new normal.

DEMAND / NEEDS FOR CONNECTIVITY INFRASTRUCTURE IN A POST-PANDEMIC WORLD



TREVOR SMITH
VP OF STRATEGY / BUSINESS DEVELOPMENT
COMMSCOPE

Bio: Trevor Smith and his team assess current and future industry trends and are also responsible for establishing and driving the Commscope strategic plan collaboratively across the organization, and for working with each business to develop their Strategy in support of the CommScope Strategy. Trevor is passionate about fiber and wireless technologies and holds over 100 patents relating to fiber optics and fiber optic networks. He has over 28 years of experience in the communications field, and has spent time in various R&D, Product Management, Marketing, and Business Development Roles with ADC Telecommunications, TE Connectivity, and CommScope. Most recently, Trevor and his team have been working on solutions for Broadband Wireless and Wired Networks, driving speed of deployment up, while also working to lower both capex and opex costs for people building networks around the world.

In addition to his role at CommScope, Trevor serves on the Board of Directors of Telecommunications Industry Association and is Chairman of the Board at Active Video Networks. Trevor has a BSME and an MBA to go along with his extensive experience in the Telecom industry.

PLENARY SESSION OVERVIEW

MONDAY, OCTOBER 4, 2021: 12:00 PM – 2:00 PM (Eastern USA)

Access to the Plenary Session is available to "Full-Access" attendees only.

ANNOUNCEMENTS/GREETINGS

Scott Wasserman; Chair, IWCS, Inc. Board of Directors, Dow, Pennsylvania, USA

David Kiddoo; CEO/Director, IWCS, Inc, Virginia, USA

KEYNOTE PRESENTATION

Connectivity Needs for our New Normal World: Network Evolution in the Cable and Connectivity Space



Trevor Smith

VP of Strategy & Business Development

CommScope

AWARDS AND RECOGNITION

Presented By

Dr. Brian Risch; Chair, IWCS 2021 Symposium Committee; Prysmian Group, Claremont, NC, USA

Jack Spergel Memorial Award for Outstanding Technical Paper

Ruben Manikkam

Heraeus Noblelight America, Maryland, USA
"Optical Arrangement and Power Consumption for UV LED System Designs in Standard Draw Tower Configuration"

Kitts-Kingsley Award for Best Presentation

Michael Dodds

Berk-Tek LLC, Pennsylvania, USA
"Twisted Pair Ethernet Applications at Lengths Greater than 100m"

Kitts-Kingsley Award for Best Presentation

Brian Risch

Prysmian Group, North America, USA
"Structurally and Environmentally Robust Flexible 16 and 24 Fiber Ribbons for High Fiber Density Cables Compatible with Mass Fusion Splicing"

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**Prysmian
Group**



EXECUTIVE SESSION

Monday, October 4, 8:30 AM – 12:00 PM

This session is designed for the general management of the wire and cable producing companies and their suppliers. Important issues facing the industry will be addressed by expert speakers in a provocative session which will be followed by a panel of industry leaders reflecting on the issues.

A Wire and Cable Market Boom Amid Risks



Chenfei Wang, Senior Analyst, CRU International, London, UK

In Europe, North America, and other regions, cable manufacturers are reporting pre-pandemic levels of cable orders as the market recovers. We still expect global cable consumption in 2021 to remain a touch below its 2019 size, driven by growth in China and a full recovery in North America and North-East Asia. Europe is forecast to remain 1.6% below its 2019 size, while Indian demand has failed to rebound strongly despite some containment of Covid-19 cases.

A key driver of the cable market's recovery is a boom in residential construction and automotive harness orders. While we expect momentum in the former to remain, albeit at a lower level, we contribute certain automotive cable orders to stock building.

Elevated and volatile commodity prices and freight costs have led to some supply chain disruptions and delayed tendering activities especially in China. Though we currently assess their impact to be limited on our annual consumption and production forecasts.

Opportunities for the Optical Cable Market in a Post-Pandemic World



Michael Finch, Head of Wire & Cable, CRU International, London, UK

Covid-19 undoubtedly had a huge impact on optical cable markets globally last year. Although the impact was variable from country to country, with the exception of the US, CRU witnessed severe disruptions, lackluster demand and ailing prices. This talk will review the underlying drivers which supported healthy US cable demand last year and the opportunities the industry faces in the coming years, comparing the US to key markets elsewhere such as China and Europe.

This talk will cover the following:

- 1.) The global impact of Coronavirus and regional variances
- 2.) Shifting demand drivers and the impact of rising investment in FTTH
- 3.) Update on the imbalance between global supply and demand and the outlook for bare fibre prices

Global Economic Outlook



Robert Fry, Chief Economist, Robert Fry Economics LLC, Greenville, DE, USA

Robert Fry will discuss current conditions in the global economy and the outlook for future growth, with emphasis on U.S. manufacturing and on markets important to the wire and cable industry. In particular, he will discuss the recovery from the 2020 recession and how it is being affected by recurrent waves of COVID-19 cases and by shortages of labor, materials, and shipping containers. Among the topics covered will be growth in GDP and industrial production, including wire & cable production, housing starts, light vehicle sales, inflation, and interest rates. A brief Question & Answer period will follow Robert's presentation.

Executive Panel Session

Perspectives on demand / needs for connectivity infrastructure in a post-pandemic world. How does a service provider meet the requirements of broadband deployment, data centers on the edge and users expansion (remote healthcare, schooling, home office, social networking, etc.) in this new paradigm.



Ric Johnsen

SVP, Broadband Networks
CommScope
Hickory, North Carolina, USA



Boh DuPree

Director, Network Investments
Facebook
Redmond, Washington, USA



Roland Montagne

Principle Analyst Broadband & FTTx
IDATE / DigiWorld Institute
France



Trevor Smith

VP of Strategy and Business
Development
CommScope
Eden Prairie, Minnesota, USA

ROUNDTABLE DISCUSSIONS

Tuesday, October 5, 12:30 PM – 1:30 PM



ADVANCING TELECOM INFRASTRUCTURE: MATERIAL AND CABLE INNOVATION FOR A MORE SUSTAINABLE FUTURE

SPONSORED BY DOW

Visit iwcs.org/dow-roundtable for full details

Advancing Telecom Infrastructure: Material & Cable Innovation for a More Sustainable Future

The plastics industry is working hard to become more sustainable. From packaging redesign to the incorporation of post-consumer recycled (PCR) plastic, we've already seen great strides from both individual companies and broad industry-wide coalitions. Academia and forward-thinking businesses are even moving toward more advanced chemical recycling processes designed to reintegrate depolymerized raw materials even further back in the value chain.

As a major consumer of plastics, the telecom industry is now faced with a tremendous opportunity...and a comparable challenge. Global demand for enhanced connectivity – demonstrated by the ongoing expansion of 5G networks and data centers, as well as the advent of intelligent buildings – has placed us at a critical juncture. We must take a serious look at wire and cable materials, designs, assembly, installation and end-of-life options to help determine the best path forward to a stronger, more sustainable industry. The following topics will be presented during this Roundtable.

Moderator: Scott Wasserman, PhD, Associate R&D Director/Intellectual Capital Mgr. – Dow, Inc.

- **Innovation for a more sustainable plastics industry**
Panel Topic Expert: Jennifer Ronk, Senior Marketing Manager, P&SP Sustainability NA – Dow, Inc.
- **Cable designs for more sustainable intelligent buildings**
Panel Topic Expert: Brian K. Davis, RCDD, Director, Global Market Development | In-Building Networks – Corning Optical Communications LLC
- **Ease of installation for enhanced connectivity with reduced environmental impact**
Panel Topic Expert: Vivian Petre, Global Product Line Manager, Fiber Drop Cable Assemblies – Commscope

Wednesday, October 6, 12:30 PM – 1:30 PM



HOW TO GUARD YOUR BRAND: MITIGATING RISK OF NON-COMPLIANT PRODUCT

SPONSORED BY UL

Visit iwcs.org/UL-roundtable for full details

How to Guard Your Brand: Mitigating Risk of Non-Compliant Product

The Roundtable Discussion will center on the issues surrounding counterfeit and non-compliant products and specifically cable which has been a continuing problem for quite some time. UL's work with Brand Protection, as well as the work conducted by Law Enforcement has been paramount in creating awareness about the problem. OSHA administering the Nationally Recognized Testing Laboratories (NRTL) program highlights the importance of Independent Test Laboratories. The following topics will be presented during this Roundtable.

Moderator: Robert LaRocca, Product Manager – UL

- **"Product Quality / Brand Protection"**
Panel Topic Expert: Lisa Deere, Brand Protection Manager – UL
- **"Homeland Security Investigations"**
Panel Topic Expert: Michael Rose, Section Chief – IPR Center, Homeland Security Investigations: Global Trade Investigations Division
- **"NRTLs (OSHA) Value of 3rd Party Certification"**
Panel Topic Expert: Tom Hannigan, Lead Auditor – US Department of Labor, OSHA NRTL
- **"UL Market Surveillance Study"**
Panel Topic Expert: Anthony Tassone, Principal Engineer – UL

Thursday, October 7, 12:30 PM – 1:30 PM



THE FUTURE OF COMMUNITY

SPONSORED BY COVESTRO

Visit iwcs.org/covestro-roundtable for full details

The Future of Community: How A Connected World Can Drive Innovation and Wellness – What Sustainable Technology Will Contribute To The Circular Economy?

Fiber Optical Materials (FOM) has a clear vision: a future of community in which communications technology will bring the world together. As we strive to build a Future of Community, we believe that everything we do, should contribute to a better world for us all. The following topics will be presented during this Roundtable.

- **DSM RFM And Covestro: The Best Of 2 Worlds**
- **How A Connected World Can Drive Innovation And Wellness**
- **The Opportunity To Increase Connectivity**
- **Technology Leadership: UV LED Inks, UV LED And Its Connection To Circular Solutions**
- **Sustainability And Circular Economy: Importance, How Circular Economy Principle Can Shape Our Industry, What Does It Mean Becoming Circular And What Does It Take? What Sustainable Technology Used Today Will Contribute To The Circular Economy?**

Panel Topic Experts:

- **Eric Urruti**, Global Science & Technology Director and Director of Fiber Optic Materials – DSM / Covestro
- **Jun Liu**, VP Marketing – DSM / Covestro
- **Sjaak Griffioen**, Director Innovation, Strategy and Sustainability – Covestro
- **Stacey Siler**, Global Marcom and Communications – DSM / Covestro

NETWORKING

Network with colleagues from around the world, have fun, and win prizes! Join us for three networking breaks throughout the week of the event.

Tuesday, October 5, 1:30 – 2:00 PM

Music Break with Prizes



Tune in for a fun break filled with music and networking. Don't worry about a thing—just show up and enjoy a curated playlist of background music while networking with other members of the industry from all around the world.

Prize drawings: IWCS 70th Anniversary Rocketbooks™

Wednesday, October 6, 12:00–12:30 PM

Coffee Break with Prizes sponsored by Teknor Apex



Grab your favorite mug, BYOC (bring your own coffee), and join us for a virtual coffee break. This networking break provides you with a great opportunity to talk with other attendees while participating in fun activities and winning prizes.

Prize drawings: YETI™ Mugs and Starbucks™ Gift Cards

Thursday, October 7, 1:30 – 2:00 PM

"70 Years of IWCS" with Prizes



Did you know the first IWCS event was 70 years ago? Join IWCS and colleagues from around the world as we celebrate the many milestones IWCS has achieved along the way—thanks to wonderful supporters like you!

Prize drawings: IWCS 70th Anniversary Rocketbooks™

SUPPLIER EXHIBITION™

Step into live, virtual booths, meet with top suppliers, and view demonstrations of the latest technologies by attending Supplier Spotlight Presentations.



TECHNICAL SYMPOSIUM SESSIONS

All Sessions / Presentations will be available "on-demand" through Friday, November 12, 2021

SESSION 1: Executive Session

Chairperson: David B. Kiddoo; IWCS, USA

Monday, October 4, 8:30 AM – 12:00 PM

This session is designed for the general management of the wire and cable producing companies and their suppliers. Important issues facing the industry will be addressed by expert speakers in a provocative session which will be followed by a panel of industry leaders reflecting on the issues.

- 1-1: A Wire and Cable Market Boom Amid Risks:** Chenfei Wang, CRU International, London, UK
- 1-2: Opportunities for the Optical Cable Market in a Post-Pandemic World:** Michael Finch, CRU International, London, UK
- 1-3: Global Economic Outlook:** Robert Fry, Robert Fry Economics LLC, Greenville, DE USA
- 1-4: Executive Panel Session: Perspectives on demand / needs for connectivity infrastructure in a post-pandemic world. How does a service provider meet the requirements of broadband deployment, data centers on the edge and users expansion (remote healthcare, schooling, home office, social networking, etc.) in this new paradigm.**

SESSION 2: Connectivity: Innovations in Processing, Density & Deployment

Sponsored by: CommScope

Chairperson: Ben Waite; Fiber Optic Center, USA

Tuesday, October 5, 10:00 AM – 11:55 AM

- 2-1: Procedure for Measuring Return Loss of Multicore Fiber Connectors:** K. Kamimura, K. Izawa, K. Imaizumi, and R. Nagase, Chiba Institute of Technology, Chiba, Japan
- 2-2: 100% Precon FTTx Network:** M. Scocco, Sterlite Conduspar, São Jose PInhais, Brazil; D. Santos, B. da Silva, and R. Gomes, Telefonica Vivo, Curitiba, Brazil; G. Cenato and M. Garcia, Rosenberger Domex Telecomunicações Ltda., Caçapava, Brazil; A. Dallagnol and L. Freitas, Sterlite Conduspar, São Jose PInhais, Brazil; and K. Tenzing, Sterlite Technologies Limited, Dadra, India
- 2-3: Standardization of Multimode Optical Fiber for Automotive Wire Harness in Next Generation Autonomous Vehicles:** R. Pimpinella, J. Castro, B. Kose, P. Huang, and B. Lane, Panduit Corp., Tinley Park, IL, USA
- 2-4: Heresy Or Breakthrough: Precision Cleaning Fiber Optic Surfaces Without Inspection:** E. Forrest, rMS (RaceMarketingServices), Atlanta, GA, USA

continued SESSION 2: Connectivity: Innovations in Processing, Density & Deployment

Tuesday, October 5, 2:00 – 3:25 PM

- 2-5: Prodigy - Small Form Factor Universal Fiber Optic Connector for Harsh Environments:** Y. Lu, CommScope, Shakopee, MN, USA
- 2-6: Novel Multi-Fiber Connector with Increased Usable Fiber Density:** M. Hughes, D. Childers, J. Hendrick, J. Higley, D. Kurtz, S. Lutz, and D. Schoellner, US Conec, Hickory, NC, USA
- 2-7: Review of Connector End Face Scratch Recognition and Verification Study for Automated Microscopes:** M. Gurreri and T. Bolhaar, CommScope, CommScope, PA, USA; J. Webb, TE Connectivity, Middletown, PA, USA; and T. Berdinskikh, Novophotonics Consulting, Toronto, ON, Canada

SESSION 3: Emerging Optical & Cable Technologies

Sponsored by: OFS

Chairperson: Eric Whitham; OFS, USA

Tuesday, October 5, 10:00 AM – 11:55 AM

- 3-1: 160- μ m Coating Optical Fiber with 80- μ m Cladding for 1,728-Fiber Cable:** H. Sato, M. Miyata, A. Murata, Y. Tsujimoto, N. Yamashita, K. Hoshi, S. Matsuo, and K. Osato, Fujikura Limited., Chiba, Japan
- 3-2: 80 μ m-Cladding Optical Fiber Compatible With ITU-T G.657B3:** Q. Zhu, P. Xue, S. Cao, Z. Wang, H. Xu, and G. Yang, Zhongtian Technology Fibre Optics Co.,Ltd., Nantong, China
- 3-3: 800 Gbps Transmission Over 8-Core Multimode Multicore Fiber for Short Reach Datacom Interconnects:** Y. Sun, R. Lingle, and C. White, OFS Fitel LLC, Norcross, GA, USA; B. Savran, T. Cotter, and M. Wen, OFS Fitel, Avon, CT, USA; and B. Holland, L. Bansal, D. Inniss, J. Earnhardt, B. Zhu, and D. DiGiovanni, OFS, Somerset, NJ, USA
- 3-4: 400 Gbps Transmission Over 4-Core Single Mode Multicore Fiber For Datacom Applications:** Y. Sun, R. Lingle, A. McCurdy, D. Peckham, T. Liang, D. Braganza, and D. Vaidya, OFS Fitel LLC, Norcross, GA, USA; R. Shubochkin and V. Cusanello, OFS Fitel, Sturbridge, GA, USA

SESSION 4: Special Applications – Copper

Sponsored by: Chemours

Chairperson: Trent Hayes, CommScope, Inc., USA

Tuesday, October 5, 2:00 PM – 3:25 PM

- 4-1: Analysis, Optimization And Verification of a HV Connector:** B. Mund, bda connectivity GmbH, Asslar, Germany; and T. Gneiting, AdMOS GmbH Advanced Modeling Solutions, Frickenhausen, Germany
- 4-2: Hybrid Cable for Laserway Pon-Lan Solution:** T. Hoppen Bianchini, L. Nogueira, M. Nardi, K. dos Anjos, W. Rosa Netto, R. Cruz, S. Joly, and H. Durigan, Furukawa Electric LatAm S.A., Curitiba, Brazil
- 4-3: Optical Wireless Communication Networks and Its Backbone Cabling:** P. Fischer, BKS Kabel-Service AG, Derendingen, Switzerland; and B. Bechadergue, Oledcomm, Vélizy-Villacoublay, France

SESSION 5: Materials & Process Technology

Sponsored by: Dow

Chairperson: Mohamed Esseghir; Dow, USA

Wednesday, October 6, 9:00 AM – 11:55 AM

- 5-1: Material Solutions for 5G and Dense Fiber Networks:** P. Brigandi, S. Saba, and M. Esseghir, Dow, Collegeville, PA, USA; T. Geussens, Dow, Horgen, Switzerland; T. Hogan and R. Anderson, Dow, Midland, MI, USA
- 5-2: Print Length Verification System:** P. Jones and C. Girdwood, Taymer International Inc., Markham, ON, Canada
- 5-3: Sequence-Coded Oligomers for Information Storage at Molecular Level as Markers for Product Authentication:** M. Matloubi, A. Al Ouahabi, and D. Kirchenbauer, Polysecure GmbH, Freiburg, Germany; M. Kemmler, Kemmler Consulting GmbH, Denkendorf, Germany; J. Moesslein, Polysecure GmbH, Freiburg, Germany; L. Charles, Aix Marseille University, CNRS, ICR, Institut de Chimie Radicalaire, Marseille, France; and J. Lutz, Precision Macromolecular Chemistry Group, Institut Charles Sadron, CNRS, Strasbourg, France
- 5-4: New Era in Keeping Constant Tension in Stranding Processes:** N. Schilling, FMS Force Measuring Systems AG, Oberglatt, Switzerland
- 5-5: A New Method to Localize Partial Discharges on Power Cables Using Time Reversal and TLM Numerical Method:** A. Ragusa, H. Sasse, and A. Duffy, De Montfort University, Leicester, United Kingdom
- 5-6: Configuration Optimizer for Fiber Optics Secondary Coating Lines:** J. Hanhirova, S. Orhanen, and M. Lahti, Maillefer Extrusion Oy, Vantaa, Finland

SESSION 6: Optical Cable Installation & Network Management

Sponsored by: Corning

Chairperson: Guy Castonguay; Corning Optical Communications, USA

Wednesday, October 6, 8:30 AM – 10:55 AM

- 6-1: Guidelines for Conducting Cable Blowing Tests:** W. Griffioen, Plumettaz SA, Bex, Switzerland; and J. Jonker, Prysmian Group, Emmen, Netherlands
- 6-2: Remote Operated Optical Fiber Switching Node and Cross-Connect Function Applied to Optical Access Network Based on Concatenated Loop Topology:** H. Watanabe, T. Kawano, C. Fukai, R. Koyama, K. Nakae, T. Fujimoto, Y. Abe, and K. Katayama, Access Network Service Systems Laboratories, NTT Corporation, Ibaraki, Japan
- 6-3: Power Supply System Using Optical Fibers for Remote Operated Optical Fiber Switching Node:** T. Kawano, T. Fujimoto, K. Nakae, H. Watanabe, and K. Katayama, NTT Corporation, Tsukuba, Japan
- 6-4: Cable Overblowing - Review & Future Developments:** R. Sutehall, L. Spicer, and S. Santamaria, Prysmian Group, Eastleigh, United Kingdom; D. Hawkins, Eden Ltd., Hayes, United Kingdom
- 6-5: Cable Friction - Influence of Cable and Duct Materials in Extended Testing:** M. Heinz, Corning Optical Communications, Berlin, Germany

SESSION 7: Optical Fiber Production and Characterization

Sponsored by: Panduit

Chairperson: Charles Glew; Cable Components Group, USA

Thursday, October 7, 11:30 AM – 12:25 PM

- 7-1: The Control and Research of Polarization Mode Dispersion in Fiber Ribbon Preparation:** B. Ma, Z. Liu, H. Yan, and J. Liu, Yangtze Optical Fiber and Cable Joint Stock Limited Company and State Key Laboratory of Optical Fiber and Cable Manufacture, Wuhan, China
- 7-2: Single-Mode Transmission over OM1 MMF: Offset Launch vs. Fundamental Mode Launch:** B. Kose, J. Castro, R. Pimpinella, P. Huang, and B. Lane, Panduit Corp., Tinley Park, IL, USA

SESSION 8: Optical Fiber Splicing and Installation

Sponsored by: CommScope

Chairperson: Michael Gurreri; CommScope, USA

Thursday, October 7, 2:00 PM – 3:55 PM

- 8-1: Temperature Independent Coupler Using Bending of Optical Fiber:** H. Hirota, Nippon Telegraph and Telephone Corporation, Ibaragi-ken, Japan
- 8-2: New Technology Enables More Consistent Low-Loss Fusion Splicing:** A. Takahashi and H. Sugawara, Fujikura Ltd., Sakura, Japan; L. Mays and D. Duke, AFL, Duncan, SC, USA
- 8-3: Time Reduction of High Fiber Count Cables Using Flexible Ribbon Technology:** J. Rando and A. Pierce, Prysmian Group, Sydney, Australia

SESSION 9: Optical Fiber Cable Design

Sponsored by: Prysmian Group

Chairperson: Jeff Barker; Prysmian Group, USA

Thursday, October 7, 8:30 AM – 11:25 PM

- 9-1: First 180 μ m Bend Insensitive Fiber in Compact Microduct Cable Yields a Record Fiber Count and Density:** C. Mentzler, A. Pastouret, H. Maerten, V. Albuquerque, A. Eremia, F. Chirita, D. Coman, P. Sillard, A. Amezcua, I. Griffiths, and G. Ferri, Prysmian Group, Milano, Italy
- 9-2: Innovative High Fiber Density Low Fiber Count Cables with Two Piece Armor:** T. Towery, E. Stupka, B. Blazer, J. Greenwood, and E. Zahir, Corning Optical Communications, Hickory, NC, USA
- 9-3: The Search for Parametric Bounds in Relation to Optical Performance:** B. Gomatam and M. Sinha, Sterlite Tech Ltd, Pune, India
- 9-4: Next Generation 6912F Flexible Ribbon Cables with Reduced Diameter:** C. Anderson, B. Wells, B. Risch, G. Lin, J. Barker, and R. Troung, Prysmian Group, Lexington, SC, USA
- 9-5: 12F and 24F Microduct Cables with Flexible Ribbon Technology for FTTx Applications:** L. Marvin, R. Chappell, R. Lovie, B. Risch, J. Barker, and D. Collado, Prysmian Cables & Systems USA, LLC, Claremont, NC, USA
- 9-6: Optical Cable Strength System for Non-Traditional Cable Design:** W. Kachmar, Technical Horsepower Consulting LLC, North Bennington, VT, USA

SESSION 10: Optical Fiber Cable Processing

Sponsored by: Corning Optical Communications

Chairperson: Mike Gimblet; Corning Optical Communications, USA

Thursday, October 7, 2:00 PM – 3:25 PM

- 10-1: Shrinkage and Protrusion Study on Different Optical Cable Structures:** J. Luo, J. Zhou, X. Miao, T. Chen, B. Shen, and W. Lu, Jiangsu Zhongtian Technology Co.,Ltd, Nantong, China
- 10-2: Shrinkage Effects On Optical Fiber Cable End Termination:** T. Schmalzigaug, and F. Englich, HUBER+SUHNER AG, Herisau, Switzerland
- 10-3: Flexible Ribbons in 144F & 288F RiCT OSP to Reduce Cable Size and Improve Manufacturability:** G. Lin, J. Barker, B. Wells, and B. Risch, Prysmian Group, Lexington, SC, USA

SESSION 11: Copper Cable

Sponsored by: REELEX Packaging Solutions

Chairperson: Bianca Hydutsky; The Chemours Company, USA

Thursday, October 7, 8:30 AM – 11:25 AM

- 11-1: Exploiting Gating Principle to Circumvent the Challenges of Properly Characterizing Cables with Improper Terminations:** L. Van Rysselberghe, B. Dardel, and V. Arbet-Engels, AESA SA, Bevaix, Switzerland
- 11-2: Influence of Delay Skew Performance Using Foam-Skin Insulation Layer for Category 6A LAN Cables:** T. Hoppen Bianchini, L. Nogueira, M. Nardi, M. de Assis, R. Cruz, S. Joly, and H. Durigan, Furukawa Electric LatAm S.A., Curitiba, Brazil
- 11-3: Quality of Twisted Pair Ethernet Applications at Lengths Greater Than 100 Meters:** M. Dodds, Leviton Manufacturing Co., Inc., New Holland, PA, USA; D. Hess, Cord Data, Wyomissing, PA, USA; X. Wu, Wandtec Optronics Co., Ltd., Austin, TX, USA
- 11-4: The Shield is the Balun:** D. Hess, Cord Data, Wyomissing, PA, USA
- 11-5: Measuring Cable Performance with Passive DUT Termination at Far End:** H. Pandya, and X. Zhu, AEM, Singapore
- 11-6: Mixing Segment Specifications for 10 Mb/S Single Pair Multidrop Enhancements:** C. Diminico, PHY-SI LLC, Chelmsford, MA, USA; P. Wachtel and R. Voss, Panduit, Tinley Park, IL, USA

SESSION 12: Codes & Standards

Sponsored by: UL

Chairperson: Dmitriy Bodik; UL, USA

Friday, October 8, 12:00 PM – 1:55 PM

- 12-1: Keeping Up with the Changes- Update On Revisions to UL'S Certification Documents:** A. Tassone, UL LLC, NY, USA
- 12-2: Statistical Validation of Cable, Connector and Cable Assembly Measurement Systems:** S. Czupryna, Objective Experiments, Bellingham, WA, USA
- 12-3: Impact of the Burner Flame Shape on Cable Burn Performance Testing According to EN 50399:** T. Meyer and W. Stöcklein, Corning Optical Communications GmbH & Co. KG, Berlin, Germany
- 12-4: Flame Shape Analysis Based on Thermography:** W. Stöcklein and T. Meyer, Corning Optical Communications, Berlin, Germany

SESSION 13: Flame Retardant Cable

Sponsored by: Dow

Chairperson: Dmitriy Bodik; UL, USA

Friday, October 8, 2:00 PM – 2:55 PM

- 13-1: Flame Retardant Structure of High Voltage Cables for Category A Bundle Combustion Test:** H. Hou and Y. Xia, Zhongtian Technology Submarine Cable., Co., Ltd., Nantong, China; S. Xie, J. Zhang, C. Fu, and H. Miao, Zhongtian Technology Group Company, Nantong, China
- 13-2: Indoor / Outdoor Cables with High-Flame Retardancy:** S. Kaneko, S. Sato, T. Sato, N. Ukiya, and K. Osato, Fujikura Limited, Chiba, Japan

SESSION 14: Special Applications - Optical Fiber

Sponsored by: Prysmian Group

Chairperson: Brian Risch; Prysmian Group, USA

Friday, October 8, 12:00 PM – 3:55 PM

- 14-1: Feasibility Study of Optical Fiber Cables for On-Road Surface Wiring:** A. Sakurai, M. Kikuchi, Y. Yamada, S. Tetsutani, and H. Tanioka, NTT Corporation, Ibaraki, Japan
- 14-2: Mechanical Reliability Tracking of Optical Fiber Under Both Environmental and Stress Corrosion:** L. Zhang, K. Mei, Z. Xiong, L. Liu, K. Chen, Z. He, and J. Luo, Yangtze Optical Fibre and Cable Joint Stock Limited Company, Wuhan, China
- 14-3: Impact of Optical Fiber Design on Microbending Sensitivity of Optical Fibers for Sensing:** B. Risch, Prysmian, Claremont, NC, USA; J. Pullman, E. Jones, P. Finley, J. Owens, and G. Pickrell, Virginia Polytechnic Institute and State University, Department of Materials Science and Engineering, Blacksburg, VA, USA; and M. Davis, Luna Innovations, Blacksburg, VA, USA
- 14-4: Long Term Response of Radiation-Tolerant Optical Fiber Designs to Gamma Radiation:** L. Plasch and L. Fick, Carleton College Department of Physics and Astronomy, Northfield, MN, USA; and B. Risch, Prysmian, Claremont, NC, USA
- 14-5: Reliability and Bend Loss in Multimode Optical Fiber in Tight Bend Applications:** S. Bickham, G. Glaesemann, Y. Shu, and G. Scannell, Corning Research and Development Corporation, Painted Post, NY, USA
- 14-6: Optical Fiber Mechanical Reliability Modeling Extended to Small Bend Radii:** G. Glaesemann and Y. Shu, Corning Incorporated, Corning, NY, USA
- 14-7: Fiber Optics in Marine Elastomeric Hoses:** D. Aubrey, EOM Offshore LLC, Pocasset, MA, USA; G. Garth, FiberNext, Concord, NH, USA; and L. Rummerl, C-POWER, Corvallis, OR, USA
- 14-8: Glass Optical Fibers for Automotive Ethernet:** M. Choudhury, OFS, Sturbridge, MA, USA; M. Shiino, Furukawa Electric Company, Ltd., Shiga, Japan; and J. Earnhardt, OFS Specialty, Avon, CT, USA

PROFESSIONAL DEVELOPMENT COURSES



This year IWCS will present the annual core courses of Materials 101, Extrusion 101, Copper 101, and Fiber Optic 101 through our live, virtual platform. Participants receive real-time education with experienced instructors in virtual classrooms—allowing you to learn, engage in conversation, ask questions, and download files on demand—all from the comfort of your own home or office! The four core courses will provide those new to our cable & connectivity industry with basic technology information. Over time, students completing the four core courses, along with two electives offered during live-event years, will be presented with an IWCS Professional Development achievement plaque.

2021 PROFESSIONAL DEVELOPMENT COURSE SCHEDULE

Monday, October 4, 2021

8:30 AM – 12:00 PM Eastern USA

Materials 101 (MA101)

Extrusion 101 (EX101)

Friday, October 8, 2021

8:30 AM – 12:00 PM Eastern USA

Copper 101 (CU101)

Fiber Optic 101 (FO101)

2021 PROFESSIONAL DEVELOPMENT COURSE DESCRIPTIONS

MA101: SELECTION & USE OF MATERIALS IN WIRE & CABLE

The course is intended for all wire and cable practitioners including raw material suppliers, cable manufacturers, and end users interested in gaining a broad understanding of applied material selection as it relates to cable performance.

INSTRUCTORS:

Dr. Mohamed Esseghir

Principal Research Scientist

Dow, Collegeville, PA, USA

Dr. Paul Brigandi

Application Development Leader

Dow, Collegeville, PA, USA

DESCRIPTION:

In this course, the selection and implementation of polymer materials used in the construction of wires and cables will be reviewed. The course will focus on polymer materials utilized in telecommunication cable applications with focus on twisted pair, coaxial, and fiber optic cables. An overview of the materials science essential to the polymer properties and additives employed in cable compounds will be covered to level- set all attendees. Further, the fundamental characteristics (advantages and disadvantages) of materials will be presented which can be then considered in selecting a material for use in a finished cable construction, with specific sections covering jackets, insulations and fiber optic materials. In addition, the effect of additives on material performance will also be discussed, particularly those that impart ultraviolet resistant and flame retardant properties on the materials.

For each of the different items (extruder, X-head, even cooling) evoked in the course, we will try to give some practical hints in relation with a more theoretical approach.

EX101: THE ART AND SCIENCE OF EXTRUSION MACHINERY FOR WIRE AND CABLE

Provides a basic analysis tool for identifying potential machinery bottlenecks due to the extrusion group, so as to solve issues which are hampering productivity and quality.

INSTRUCTORS:

Dr. Stéphan Puissant
Process Manager
Nexans Research Center, Switzerland

Mick Hundley, PE
Technical Manager
LyondellBasell, Cincinnati, OH, USA

Dr. Steven W. Horwatt, *Product and Application Development Scientist*
Equistar Chemicals, LP a LyondellBasell Company, Cincinnati, OH USA

DESCRIPTION:

The complete extrusion process is complex and involves a lot of machines having each a different function. The heart of the process being extrusion, we focus in this course on the extrusion group, i.e. extruder and cross head (distributor and tooling).

The single screw extruder seems to be a very simple machine. However, the extrusion process is complex as it is governed by interacting laws from different mechanical engineering fields i.e., thermodynamics, flow mechanics, properties of solid and molten polymers etc. Therefore, in a first step, the physical characteristics (viscosity, conductivity, melting) of polymers used in extrusion are presented. These properties will be the keys to understand the functioning of the thermoplastics extrusion process.

The material basis being covered, the focus will shift on the functioning of the single screw extruder. There the 3 functional zones of the extruder are introduced. For each zone, we will see its functioning in relation to material properties. This mechanism having been described, we will obtain some hints of the optimal screw designs (for some broader plastic families!), so as solutions which may be used to solve problematic issues.

After being plastified (molten), the polymer will be formed in its final shape by some extrusion head. In this part of the course, the basics of distributor design according to the materials are presented. After discussing the effects of distributor geometries, we will also compare different tool designs. And the influence of temperature settings on concentricity, adhesion and surface quality will be shown.

For each of the different items (extruder, X-head, even cooling) evoked in the course, we will try to give some practical hints in relation with a more theoretical approach.

CU101: FUNDAMENTALS OF COPPER CONDUCTORS & METALLIC CABLE DESIGN & APPLICATIONS

Introduction to the design and application of copper conductor communications cables.

INSTRUCTORS:

Trent Hayes, *Engineering Director*
CommScope, Inc., Claremont, NC, USA

Larry Bleich, *Engineering Director*
CommScope, Inc, Catawba, NC, USA

DESCRIPTION:

An introduction to the design and application of copper conductor communications cables. Students will understand how coaxial, twisted pair and twin axial cables are designed and how they operate upon completing the class. The instructors will provide background material on the history of copper cabling followed by sections on applications, design and construction of cables. Current standards and design examples are also reviewed by the instructors. Materials that are typically used in copper conductor communication cables will be incorporated at a fairly high level into the design exercises.

F0101: FUNDAMENTALS OF OPTICAL FIBERS & FO CABLE DESIGN & APPLICATION

Overview of optical fiber fundamentals and optical cable design principles to those new to the fiber optic cables.

INSTRUCTOR:

Corey Keisler, *Senior Development Engineer*, Corning Optical Communications, Hickory, NC, USA

DESCRIPTION:

This course will explore several aspects of optical fiber and cable design technology with particular focus on products for communications. It will discuss application considerations to select a product appropriate for a given installation environment and the basic considerations necessary for successful design of optical fiber cables.

The first part of this course will outline the characteristics and fundamental operating principles of optical fibers and the key differences between Single-Mode and Multimode optical fibers. Included will be critical fiber parameters and their impact on system performance. Specific topics will include the Advantages of Optical Fiber, Optical Fiber Manufacturing, Total Internal Reflection, Attenuation, Dispersion, Polarization Mode Dispersion (PMD), Cutoff Wavelength and other optical parameters critical to optical communications.

The second part of this course will explore the functional requirements of optical fiber cables and some of the fundamental design equations which can be used to ensure a cable will meet a given installation or operational requirement. The course will also discuss selection of a product appropriate for a given installation environment. Structural differences between cables for indoor, outdoor, and specialty applications will be explored including stranded loose tube cables, central and stranded tube ribbon cables, tight buffered cables and optical power ground wire cables.

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PARTNER LEVEL

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We design and manufacture a wide range

of compounds for a variety of cable types. Our materials are SMOKEGUARD for plenum cables; MEGOLON low smoke halogen-free compounds; GARAFLEX thermoplastic elastomer compounds; GW series flame retardant PVC compounds; GARATHANE thermoplastic urethane compounds; and GARATONE color concentrates. We often develop materials specific to customer applications. Our manufacturing sites are located in the US, UK, Mexico and Colombia and we recently acquired majority share ownership of Shakun Polymers Pvt. Ltd in India.

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Cable Components Group is a specialty compounder and extruder based in Pawcatuck, Connecticut, USA. Cable Components Group specializes in fluoropolymer-based compounds for wire and cable, extruded tapes, tubes, rods and cross webs for wire and cable, as well as filaments and fibers for the advanced composites industry. Product brands include FluoroFoam®, FluoroChar® and FluoroSpun® in addition to FiberSpun™, FluoroTone™, Cablethane™ and CableFil™. Cable Components Group supplies essential components, compounds and ingredients to the world's largest manufacturers of fiber optic cables and copper-based wire and cable products. CCG is a proud member of Bicsi, the Wire Association International (WAI), the Communications Cable & Connectivity Association (CCCA), and an ardent supporter of the International Wire & Cable Symposium (IWCS).

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CommScope is a global leader in connectivity solutions for communications networks. We provide infrastructure solutions for wireless, business enterprise, residential broadband and carrier wire line networks with industry-leading brands such as Andrew®, SYSTIMAX® and HELIAX®. Founded in Hickory, North Carolina more than 30 years ago, CommScope and its worldwide team of more than 13,000 employees create infrastructure solutions for communications networks in more than 130 countries.

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Corning is one of the world's leading innovators in materials science, with a 167-year track record of life-changing inventions. Corning applies its unparalleled expertise in glass science, ceramics science, and optical physics along with its deep manufacturing and engineering capabilities to develop category-defining products that transform industries and enhance people's lives. Our Optical Communications segment is a leading manufacturer that delivers connectivity to every edge of the network, from wavelength management, optical fiber, cable, hardware & equipment to fully-optimized optical communications systems solutions worldwide.

www.corning.com

Covestro LLC is one of the leading producers of high-performance polymers in North America and is part of the global Covestro business, which is among the world's largest polymer companies. Business activities are focused on the manufacture of high-tech polymer materials and the development of innovative solutions for products used in many areas of daily life. Covestro has 30 production sites worldwide and employs approximately 17,000 employees.

www.covestro.com/en

Dow Wire & Cable, a supplier of insulation and



jacketing materials to the telecommunications industry for over 40 years, is growing and diversifying through its unique capability to translate end-user unmet needs into tangible material science solutions.

www.dow.com



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Huber for almost four decades has been a trusted supplier of alumina trihydrate (ATH), magnesium hydroxide (MDH) and engineered molybdate compounds. We are the leading global supplier of halogen-free fire retardant additives offering the broadest product line to exceed the most demanding requirements of wire and cable compounders and producers. Our technical and commercial expertise is the foundation to developing innovative treated and untreated products and solutions that meet the exacting requirements for each application. In 2016, we acquired the Martinswerk mineral flame retardants and specialty chemical businesses of Albemarle Corporation. This acquisition complements Huber's existing portfolio of halogen-free fire retardants and smoke suppressants while expanding its geographic presence and global reach and marks the fourth and largest acquisition to the Huber fire retardant additive business in the last eight years. In 2015, Huber purchased the Safire® nitrogen and phosphorous flame retardant technology from Floridienne Group and Catena Additives. In 2012, Huber bought the specialty hydrate flame retardant business from Almatris and in 2010, the Kemgard® flame retardant and smoke suppressant business from Sherwin-Williams. Along with our global presence and comprehensive array of fire retardants and smoke suppressants, Huber is dedicated to outstanding technical service, fire retardant testing and customer care.

www.hubermaterials.com/



The Lapp Group first established in Stuttgart, Germany has been a manufacturer of Wire and Cable since the company's inception over 50 years ago. Since that time, the Lapp Group grown through their worldwide locations to accommodate customers on a global scale. As evidenced by their several testing laboratories the Lapp groups dedication to research and development has established them as the global innovator to the wire and cable industry.

Lapp products are used throughout the world in automotive plants, machine tools, instrumentation, medical electronics, telecommunications, robotics, industrial automation, transportation, general industrial control systems, and numerous other applications.

www.lappgroup.com

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PARTNER LEVEL (CONTINUED)



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OFS is a world-leading designer, manufacturer and provider of optical fiber, fiber optic cable, FTTx, optical

connectivity and specialty photonics products. Our manufacturing and research divisions work together to provide innovative products and solutions that traverse many different applications as they link people and machines worldwide. Between continents, between cities, around neighborhoods, and into homes and businesses of digital consumers we provide the right optical fiber, cable and components for efficient, cost-effective transmission.

OFS's corporate lineage dates back to 1876 and includes technology powerhouses such as AT&T and Lucent Technologies (now Alcatel-Lucent). Today, OFS is owned by Furukawa Electric, a multi-billion dollar global leader in optical communications. Headquartered in Norcross (near Atlanta) Georgia, U.S., OFS is a global provider with facilities in Denmark, Germany, Russia and the United States.

www.ofsoptics.com



Prysmian Group is world leader in the energy and telecom cable systems industry.

With almost 140 years of experience, sales exceeding €11 billion (pro-forma as of 31.12.2017), about 30,000 employees in over 50 countries and 112 plants, the Group is strongly positioned in high-tech markets and offers the widest possible range of products, services, technologies and know-how. It operates in the businesses of underground and submarine cables and systems for power transmission and distribution, of special cables for applications in many different industries and of medium and low voltage cables for the construction and infrastructure sectors. For the telecommunications industry, the Group manufactures cables and accessories for voice, video and data transmission, offering a comprehensive range of optical fibres, optical and copper cables and connectivity systems. Prysmian is a public company, listed on the Italian Stock Exchange in the FTSE MIB index.

www.prysmiangroup.com



Teknor Apex has supplied the wire & cable industry with a wide range of standard and custom vinyl compounds for over 70 years. We are a market leader in providing a full range of RoHS-compliant, UL-Recognized extrusion and molding compounds.

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Underwriters Laboratories has the expertise, testing capability, brand recognition and global presence needed to provide a full portfolio of wire and cable testing services

for Fire Safety, Performance Verification, Component Cabling and Compound Performance to the industry. Our investigation services are supported by one of the most comprehensive Follow-Up Programs in the third-party certification industry that helps users, specifiers, distributors and manufacturers identify cabling products that meet nationally recognized safety requirements as well as industry specifications for performance and quality.

www.ul.com

GOLD LEVEL



Carris is a highly efficient manufacturing company with a participatory business culture that has been competing successfully in the domestic and global markets for over 70 years. Carris strives to be a good citizen in the communities in which it operates and has long been a committed steward of the environment. At Carris, customers come first, and its collaborative culture translates to creative solutions and responsiveness to changing needs. The proof of Carris' value is demonstrated by the trust that its customers place in Carris as their business partner of choice.

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Fiber Optic Center, Inc., (FOC), is an international leader in distributing fiber optic

components, equipment and supplies and has been helping customers make the best cable assemblies in the world for over two decades.

www.focenter.com



M. Holland is a leading international distributor of thermoplastic resins, providing suppliers with the most strategic channels to market, offering innovative sourcing and supply chain solutions to our clients, and helping people lead rewarding careers.

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Nabaltec is a manufacturer of environmentally friendly, flame-retardant fillers and special oxides. These highly specialized products have been developed using aluminum hydroxide and aluminum oxide as a basis, and they are sold primarily for two market segments, namely "Functional Fillers" and "Specialty Alumina". To provide one example, flame-retardant fillers are used in cables and electronic devices. In case of fire they can delay its spread and suppress the development of environmentally harmful and unhealthy smokes and fumes. Special oxides are used e.g. for various machine components as well as in the refractory industry. Nabaltec manufactures at three locations: in Germany and in the USA.

www.nabaltec.de



Since 1976, the unique REELEX figure-eight coiling method has provided manufacturers with a tangle and twist-free packaging alternative to reels, spools and standard coiling methods and has become widely accepted as the standard package for "last-mile" lengths of low-voltage cabling.

REELEX Packaging Solutions develops and supports the REELEX system by designing and manufacturing coiling and packaging equipment, ancillary equipment such as dancers, accumulators and payoffs, developing new packaging innovations and providing service and support around the world.

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Kuraray America is a global leader in specialty chemical, fiber and resin production. With top-of-the-line research and production facilities located in Houston, Texas, and a vast network of supply from around the world, Kuraray leads the industry in specialty chemical, fiber, resin, and elastomer products. Producers of high performance Vectran™ LCP fibers since 1990.

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Siccet is a family run business in Northern Italy that produces special cables. It was founded in 1977 and over the years thanks to continuous innovation in production processes and investing in research into new materials, it has become established and grown as a reliable, flexible, dynamic and always customer oriented company, providing the most suitable and best service solution. Focus has always been on the high-quality production of thermocouple cables, compensating/extension cables and RTD cables. The experience gained in such critical fields of application, allowed Siccet to expand its production of special cables over time into other areas where critical environments require high performance (e.g. the energy sector and Oil & Gas).

www.siccet.com

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