DSM

# DSM and Telcordia Partner with FTTH Council to Raise Awareness of Performance Issues in Optical Fiber

More than 40 industry professionals participated in a DSM Sponsored FTTH Council Webinar last month, entitled "Driving the New Optical Future: How Standards can help Fiber gain Critical Mass in 2010." Steve Schmid, Director of Research and Development Optical Fiber Materials for DSM Desotech opened the session with an overview of the business, government and technological conditions that are shaping the roll out of fiber optic cable networks in the US and other developed markets. Key points included:

- Business, regulatory and political conditions are starting to fall into place to enable wide-scale roll out of fiber optic networks.
- The industry is turning its attention to ensuring that the equipment used in these networks is of high enough quality to support uninterrupted service for the lifetime of the network and flexible enough to cope with the major demands on bandwidth that we will witness in the coming years.

Dr. Osman Gebizlioglu, Director, Optical Analysis Services Network & Product Integrity, Telcordia Technologies, Inc., built on this idea to discuss the implications of two quality and performance issues: signal attenuation due to macrobending and microbending in optical fiber. Key points included:

- Increasing occurrences of macrobending and microbending are evidenced at higher wavelengths - exactly the wavelengths that will be required to meet the high bandwidth demands of the future.
- Macrobending normally occurs when fiber is forced to navigate tight corners during deployment, something which is more and more important as fiber becomes increasingly embedded in homes and MDUs.
- Microbending is an altogether different problem. Microbending is caused by random microscopic bends in the optical fiber that contribute to light displacement and increased attenuation. It occurs in places where the fiber axis has very small deformations, with amplitude at micrometers or less over lengths of millimeter level, causing attenuation and, ultimately, signal transmission losses.
- While not widely understood by the industry, microbending has been proven to cause significant signal attenuation - generally at cold temperatures. Two cases were cited:
  - In North Eastern US, a service –affecting incident was attributed to microbending-induced failures on buffer tube due to the wrong choice of material and buffer.
  - In the winter of 2008-2009, a service-affecting incident in Asia was attributed to non-optimal coating behavior on fiber.
- While glass manufacturers have made great strides in producing fiber that maintains quality of transmission even under accentuating circumstances, microbending cannot be compensated for by the quality of the glass in the cable, but by the coating that protects it.
- The newest generation optical fiber coatings are proving successful in mitigating signal loss due to microbending.

The session ended with a discussion of the role standards can play in ensuring the vital missing ingredient for successful fibre deployment. Key points included:

- DSM, Telcordia and other industry partners, have been working to introduce test method development for microbending-induced attenuation of a broad range of optical fiber products. Among the four IEC TR62221 test methods, Method D is being promoted for its effectiveness, accuracy and inter-laboratory repeatability.
- A key advantage of method D is that it effectively suppresses the effects of macrobending in the test and provides certainty that the attenuation being measured is a result of microbending.
- A standard test method development proposal was presented at the August and November 2009 meetings of the Telecommunications Industry Association TIA TR-42.12 Subcommittee on Optical Fiber and Cables.

Following the Webinar, participants were invited to provide feedback and ask questions. Below are responses from DSM and Telcordia to some of the most thought-provoking comments.

**There has been no real field failure to date due to fiber microbending, so why does the industry need a microbending test method?**
With regards to the example used in the presentation, there was extensive verification of the nature of the failure. The fact that the failure was associated with very long spans and the dependence of the loss on wavelength in the 1550nm and 1625nm range essentially pointed to microbending. The fact that when temperatures returned to normal, attenuation returned to normal tolerances also pointed heavily to thermally-induced microbending.

Overall, improved microbend sensitivity minimizes fiber's signal loss over time and distance and, as signal reliability increases, so does the reliability and cost-effectiveness of the overall network.

Given the growing number of networks being laid, and the huge investments that they represent, we believe there is an overwhelming need for operators, investors and consumers to be able to have confidence that the fiber being installed can last a 20-30 year lifespan—even at the higher wavelengths of 1550nm and 1625nm that we will be seeing utilized more and more. An industry standard for micro bending performance is the best way to ensure this.

As a side note, establishing an industry standard for microbending is actually not new: the NTIA was looking into creating such a standard back in the 1990s, before things got knocked off track with the telecom crash of the ea

**In the scope of TR 62221 it says ""The results.... can only be compared qualitatively."" If this is so, can this method be used as a valid standard?**
We firmly believe a quantitative result is achievable using Method D. That said, we acknowledge that additional work needs to be done to establish it as a quantitative test.

IEC TR 62221 was published to summarize the results of past industry efforts toward developing effective optical fiber microbending test methods. These industry efforts included round-robin testing for Methods B and D, and concluded that Method D showed good accuracy and inter-laboratory repeatability. However, additional refinements to establish it as a quantitative test method could not be completed due to unfavorable business and economic conditions. In recognition of the significant volume of work done on the test method development, it was considered to be important to capitalize on the results that led to the publication of the IEC TR 62221.

DSM in collaboration with Telcordia proposed to revisit test method development for microbending-induced attenuation of a broad range of optical fiber products. Among the four IEC TR62221 test methods, Method D was selected for its effectiveness. In addition, DSM and Telcordia are launching a test program that has involved testing at independent test laboratories. A standard test method development proposal was presented for industry feedback and participation at the August and November 2009 meetings of Telecommunications Industry Association TIA TR-42.12 Subcommittee on Optical Fiber and Cables. A similar proposal will be advanced at the next meeting of IEC (International Electrotechnical Commission) SC86A Subcommittee on Optical Fiber and Cables.

**-60°C is not relevant for the proposed microbending test method**
The quality of fiber optic coatings is key to the long-term reliability of networks and ensuring that quality means that these coatings must be tested under the most rigorous of conditions. Our methodology assumes a high degree of rigor, testing at -60°C, to give an indication of microbending impact under extreme conditions and make up in a lab environment for all the unknowns in the field that include such things as varying cable designs. In short, if the coating can perform at this extreme, we have a good indication that it will perform in the field under virtually any conditions.

In terms of the actual test referenced in the Webinar; the data we used is based on real world conditions, using true in-the-field failures. The test used in the true failure showed attenuation loss at more benign temperatures.  This suggests that even under less stringent conditions there could be cause for concern from thermally-induced microbending.

**Many critical facts about the data were left out, particularly that the one showing microbending as a function of temperature was shown to be a macrobend effect and had nothing to do the optical coating. Based on the data in this presentation it is clear that Telcordia and DSM are not listening to the industry.**

We respect and welcome different views on optical fiber performance, we believe however, that it's important not to confuse the conditions that affect macrobending performance with those that affect microbending. It's also important to understand that a focus on microbending does not negate the importance of addressing macrobending. Both are relevant and both need to be addressed. We know the circumstances under which macrobending occurs. We are now educating the industry on the conditions under which microbending occurs and hence our strong desire to adopt a standard for testing that will help identify and resolve microbending-induced attenuation through improved processes and superior technologies.

We have chosen to address microbending performance because we believe, and have demonstrated, that thermally induced microbending in optical fiber is a risk factor in the production and deployment of fiber optic cabling. We also believe that our technology provides an additional level of reliability and assurance in microbending performance.

**I disagree with the Basket Weave test method (method D) it is not useful in correlating cable data.**

DSM is working with its customers to correlate data and the different methods used. However, method D is the only one that enables effective temperature cycling and is the best method for predicting performance in the field.

One indisputable advantage of method D is that it effectively suppresses the effects of macrobending in the test because the quartz core mandrel being used to wind the fiber has a diameter of 111 mm—large enough to eliminate macrobending effects. Thus, in using Method D, we have certainty that the attenuation being measured is a result of microbending.

The bottom line is that microbending exists, and it is an issue for the industry. Based on the industry efforts to date to develop microbending test methods, Method D is considered to be the best approach to test for thermally induced optical fiber microbending.

**Do we really need to revise the GR-20 and increase expenses for all the fiber manufacturers?**

Revising the GR-20 is a positive, "future-proofing" move for all players in the value chain. Bandwidth demands continue to explode and that means that fiber must be able to reliably handle greater and greater through-put demand. Because the quality of fiber optic coatings is key to that long-term reliability, deploying substandard materials means running the risk of being penny-wise and pound foolish. Ensuring a rigorous common standard of performance for all optical fiber coatings on the front end involves much less financial risk than ending up with an installed network that cannot last 20-30 years in the field or be able to perform at the higher bandwidths of 1550nm or 1625, which we believe will become an inevitable requirement.

**Companies are behind in reliable products if they haven't already addressed these issues in R&D on product development**

We agree. The good news is that more than half of the world's fiber producers have addressed microbending performance by adopting the newest generation optical fiber coatings in their products. Unfortunately not every coating solution on the market addresses microbending propensity and, to date, there is no standard for testing optical fiber for microbending performance. There is still work to be done educating the marketplace about the impacts of thermally-induced microbending on signal attenuation and the value of having a reliable industry standard and testing methodology for screening optical fiber products for microbending performance. DSM and Telcordia are committed to addressing this industry need.

**What will improvements in fiber coating enable in future cable designs?**

Improvements in optical fiber coatings are making design easier and reducing the number of controls required in the manufacturing process. Coatings allow manufacturers to squeeze more fiber into a given piece of real estate—such as more ribbons in a cable—without attenuation issues. They also help the fiber perform at lower temperatures—even lower than the -40°C currently specified in the industry—enabling a wider range of operation. Equally important is that next generation coatings will help ensure fiber performance as the industry moves to higher wavelengths to meet the burgeoning demand for bandwidth.

**Is it reasonable to ignore the materials and design of buffer tubes and their effect of macro/micro-bending losses in developing the new standards? Certainly reliability in preventing bending losses inherently in the fibers is important, but in practice, the interaction of the fibers with the buffer tubes and other cable components will be critical in overall cable performance.**
We agree. Our focus in testing is not intended to ignore or exclude any variable – especially cable environments. However, there is abundant knowledge and awareness of the impacts of cabling design on performance, but very little about the impact of microbending on the performance of the individual fiber. We have considerable expertise in this area and as such, are focusing on it and on the role of fiber coatings in providing additional safeguards to the performance and reliability of the cable. We sincerely hope that cable manufacturers will join us in addressing this important need for standardized approaches to evaluating thermally-induced microbending in optical fiber production.

To learn more about this topic, contact Patrick Foarde at Patrick.foarde@ketchum.com or 1-404-879-9254

**About DSM Desotech**
DSM Desotech is the global leader in the development and supply of UV-curable fiber optic materials. The company works with the world's largest manufacturers of optical fiber cable to help deliver a higher level of fiber performance-and to lower risk for network service providers. DSM is pioneering research and development in coating technology to improve microbending performance in optical fiber. For more information about the company please visit our Website at www.supercoatings.com.