

The Longevity and Use of Index-Matching Gel in the UniCam[®] Connector and CamSplice[®] Mechanical Splice

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This AE Note discusses the use of index-matching gels in fiber optic components. Index matching gel is reliable and proven to withstand the rigors of outside plant installations. The following provides a detailed explanation of testing and uses of index-matching gel.

Testing

Index-matching gel is a chemically stable substance that has no shelf life. To verify its longevity, Corning Optical Communications has performed environmental testing on the index-matching gel used in our products to evaluate the long-term aging of the gel in splice components. These tests include:

- Thermal cycling (-40°C to +80°C for 200 cycles)
- Thermal aging (+80°C for 21 days)
- Thermal shock (+60°C to -40°C for 10 cycles, transition time of less than one minute)

Corning Optical Communications' index-matching gel conforms to the following material requirements:

- Equilibrium water content \leq 100 parts per million
 - No particles or inclusions, which might interfere with optical transmission
 - Sufficiently high viscosity to prevent flowing
 - Optically clear over time
- High surface tension to fill any voids during fiber movement

History

Index-matching gel was first used in the optical fiber industry in 1978 as an integral component of the GTE Elastomeric Splice[®]. The Elastomeric Splice was widely deployed and still has a large installed working base. US West presented a paper in 1990 that examined a system employing GTE Elastomeric Splices originally installed in 1985¹. The system was upgraded to 1.12-gigabit operation in 1988. Prior to the upgrade the optical fiber links were tested for attenuation, optical return loss, and bit error rates. Results of these same tests were compared to those performed when the system was originally commissioned in 1985. No problems with the gel were observed in the study.

Many products have since been developed and widely deployed that use the same index-matching properties of the gel to reduce reflectance and insertion loss in optical fiber splicing. Among them are:

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AEN046, Revision 4 - Page 1 of 2

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- The AT&T Rotary Splice[®] that has been used almost exclusively as the splice method for AT&T long lines and was a system standard component at Bell South until 1989.
- A host of non-adhesive fiber optic splices emerged in the late 1980s (after the water-blocking properties of index matching gel were discovered), including the Corning Cable Systems CamSplice, the AT&T CSL[®], the 3M FibrLok[®] and the AMP Finger Splice[®]. They have all had success in the field as epoxy-less mechanical splices that incorporate index-matching gel.
- A line of “hybrid” connectors has married the mechanical splice and connector technology together. In 1989, Corning Optical Communications introduced this technology in the connector family known as the CamLite[®] (first generation). The UniCam[®], containing the same splice components, later followed as the second generation.

Summary

In summary, index-matching gel has been used as a medium for optical fiber splicing since the 1970's with great long-term success in field applications. Substantial lab testing has been conducted, with great success, to simulate aging of this material. It has been verified through both testing and field experience that the use of index-matching gel in the UniCam[®] and CamSplice[®] will not limit the life of the products, nor compromise our customer's needs in the future.

For more information, please see:

Corning Optical Communications Applications Engineering Note 004, “Fiber Reflections”

Reference

- 1) “Field Results Measuring Optical Reflections”, Greg L Kissler US West Comm., Proc. 6th Annual NFOEC, April 2-5. 1990, Lincolnshire, IL. Pp. 5.1.1-5.12