Impact of water droplets on Expanded Beam (Lensed) Connector Insertion Loss

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Modeled Insertion Loss – Polymer Lens

Without Index Matching Gel, Total Loss = 1.85dB

With Index Matching Gel, Total Loss = 1.05dB

Index matching gel
C-Lens
Impact of water – commercial C-Lens

Dry Lenses
Loss = 1.08 dB

Water added

Large droplet of water (leaked off)
Loss = 1.17 – 1.26 dB

Small droplets remaining
Magnified view

Dry

Droplets
Laser Cleaving
Lot B: Multimode fiber, Sample # B004

Index depression clearly visible
Results: Multimode fiber samples

Maximum Cleave angle = 0.7°
Lot A: Single-mode fiber, Sample # A001

Core is clearly visible
Results: Single-mode fiber samples

Maximum Cleave angle = 0.7°
Optical coupling at interface
- Laser cleaved convex to mechanical cleaved flat end face

- Laser cleaved Stub fiber
- Mechanical cleaved Field fiber

- Spatial filtering at interface
  - Loss in coupled modes
- Can result in Modal Noise
  - Fluctuations of optical power at receiver
  - Reduced SNR
  - Performance degradation

Increase in NA
Standards specified end face geometry

Critical specifications
1. Radius of curvature
2. Apex offset
3. Protrusion
Summary

- Insertion loss for lens coupling can increase with water droplets – can be coated with hydrophobic

- The increase in IL is on the order of 0.25 dB

- Water ingress can be limited if required

- No requirement for water immersion for new high-bandwidth automotive optical connectors