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

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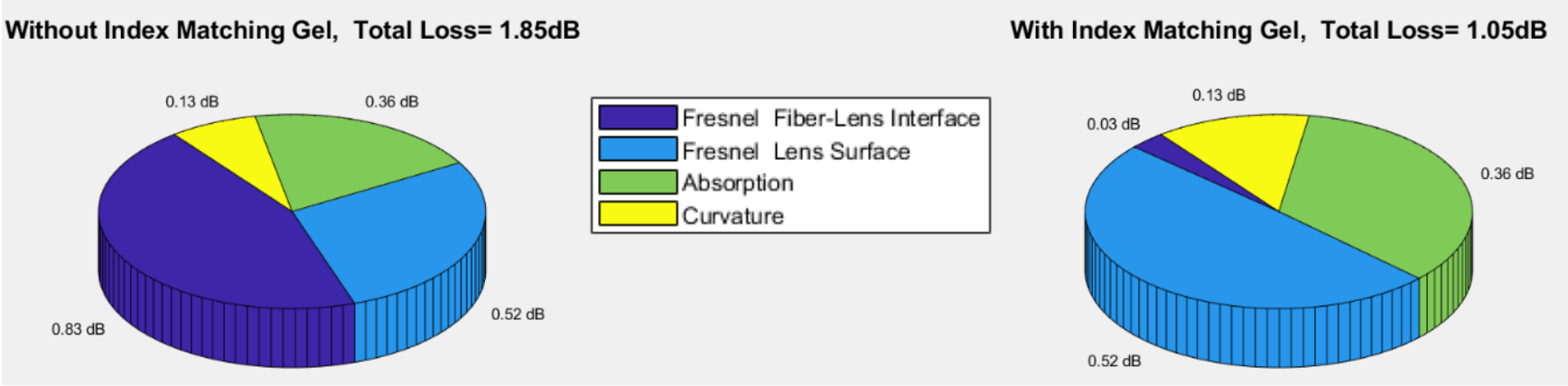
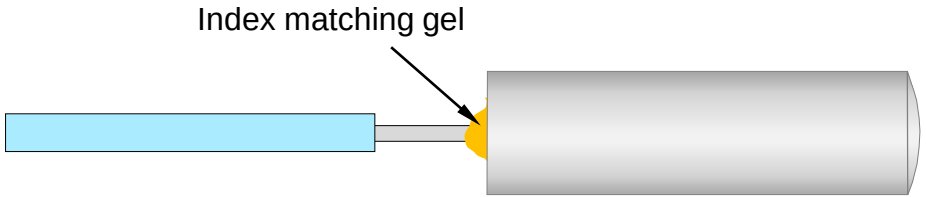
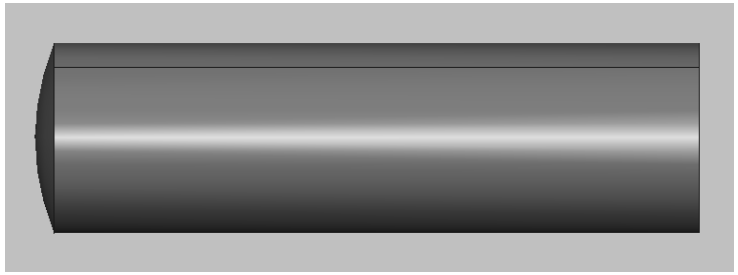
Ad hoc Telecon, August 4, 2020

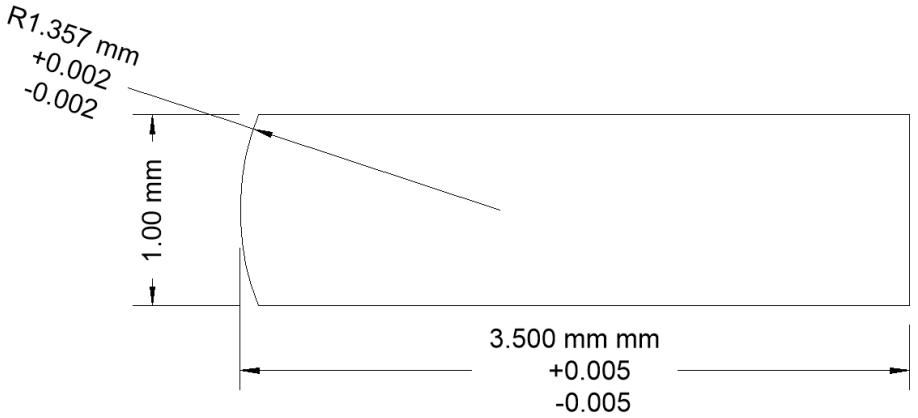
Modeled Insertion Loss – Polymer Lens





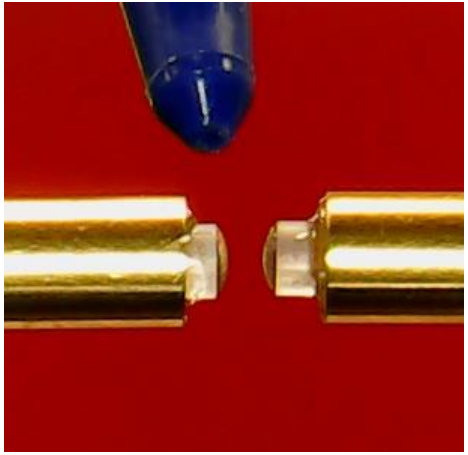
C-Lens





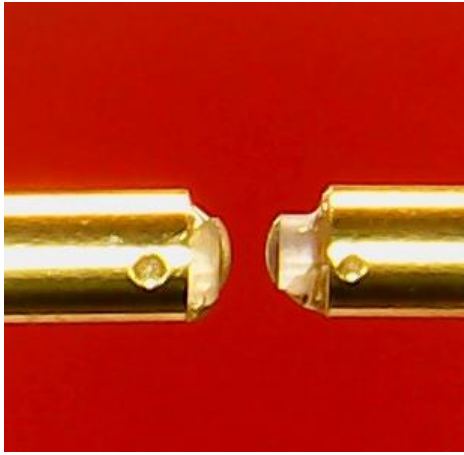
Impact of water – commercial C-Lens

Dry Lenses
Loss = 1.08 dB



Water added

Large droplet of water
(leaked off)



Small droplets remaining
Loss = 1.17 – 1.26 dB

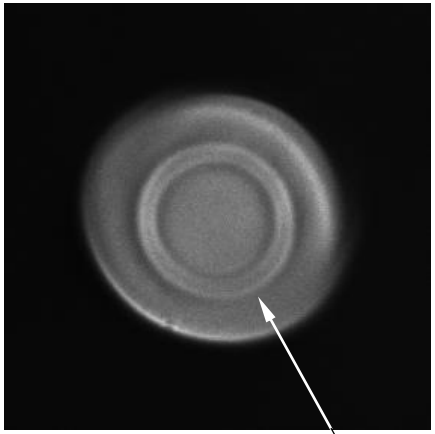
Magnified view

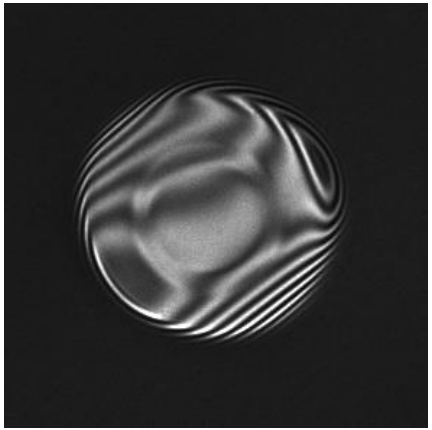
Dry

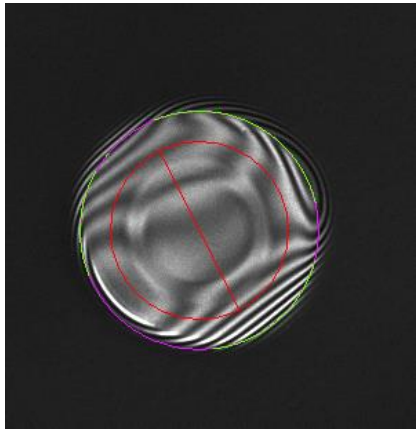
Droplets

Laser Cleaving

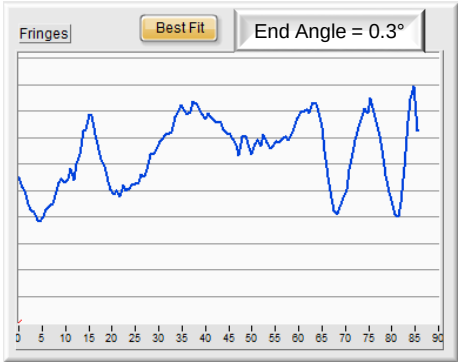
Lot B: Multimode fiber, Sample # B004



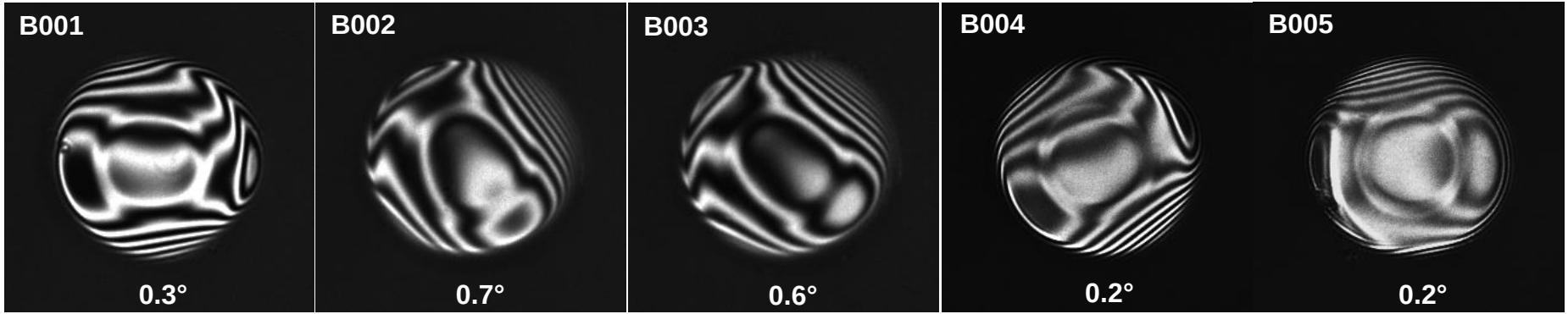




Index depression clearly visible

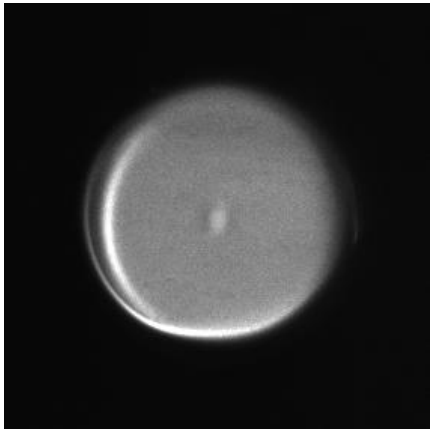


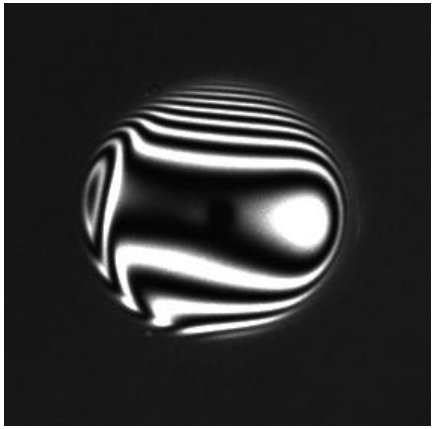
Results: Multimode fiber samples

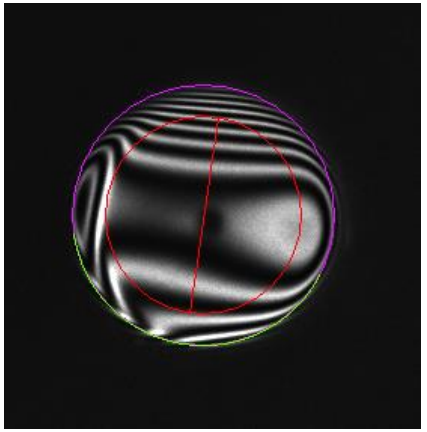


Maximum Cleave angle = 0.7°

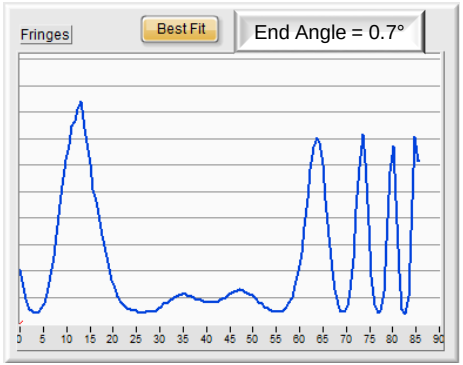
Lot A: Single-mode fiber, Sample # A001



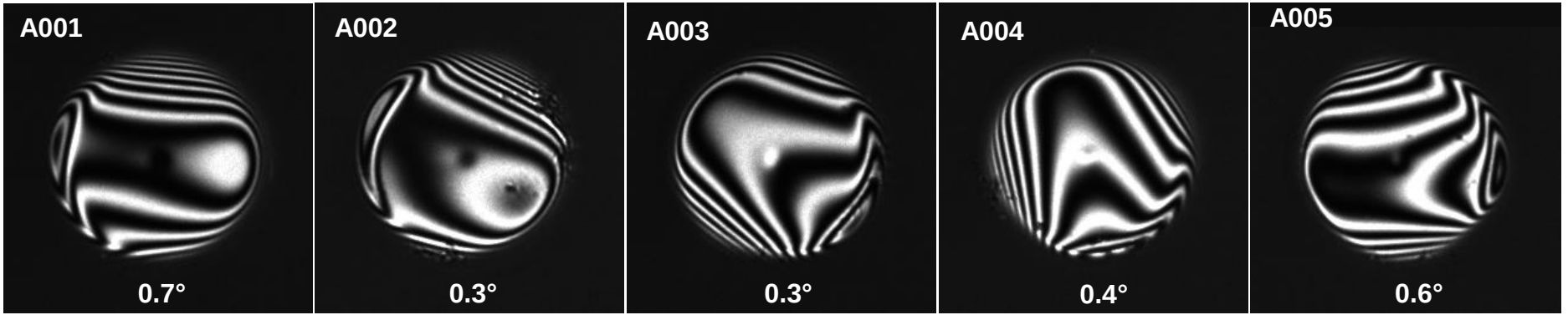




Core is clearly visible



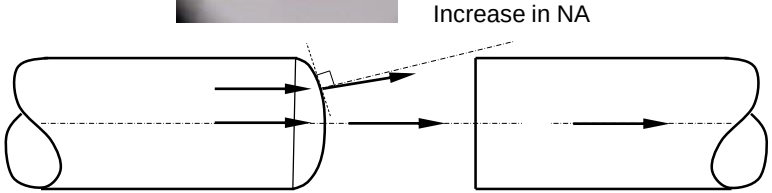
Results: Single-mode fiber samples



Maximum Cleave angle = 0.7°

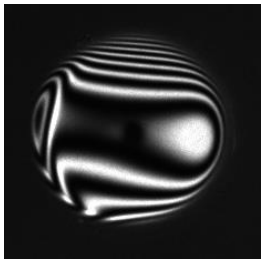
Optical coupling at interface

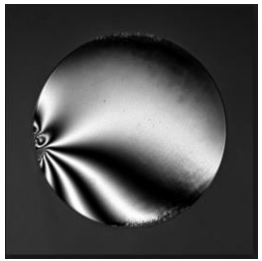
- Laser cleaved convex to mechanical cleaved flat end face



Laser cleaved Stub fiber

Mechanical cleaved Field fiber



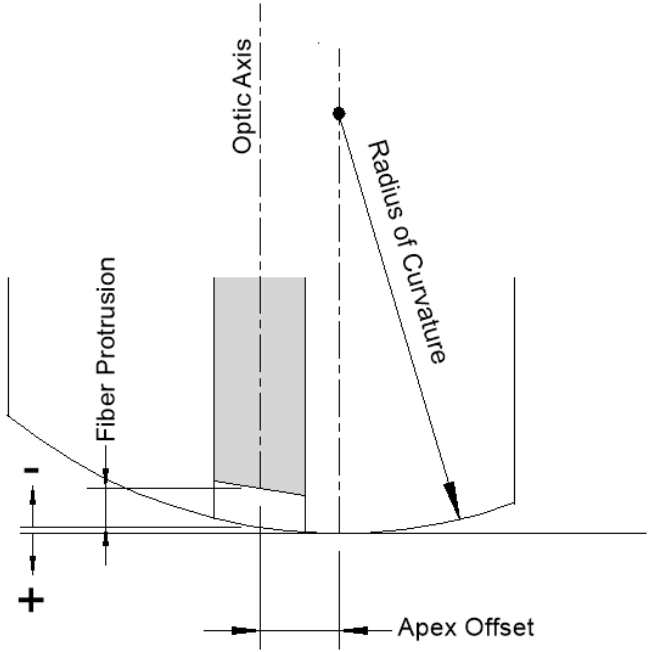


- Spatial filtering at interface
  - Loss in coupled modes
- Can result in Modal Noise
  - Fluctuations of optical power at receiver
  - Reduced SNR
  - Performance degradation

Standards specified end face geometry

Critical specifications

1. Radius of curvature
2. Apex offset
3. Protrusion



Polishing

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