The Halo Effect on Fiber Optic End Faces: Cause and Prevention

A common contamination defect typically appearing on fiber optic and end face connections, haloing is characterized by a discolored ring located midway between the fiber core and the leading edge of the chamfer. Because it is not generally visible on the fiber optic core, some may dismiss its impact on transmission. Those responsible for maintenance and installation of fiber optic networks, however, recognize potential problems such as loss in signal quality and serious damage caused by halo contamination. While some may debate whether or not this defect will distort a signal, its presence is a definite indicator of end face cleaning process failure.

Composed of small particles and soluble or semi-soluble substances, the composition of halos is best described though their origins. Potential sources include handling oils or salts from worker hands, airborne soils and particles, impurities present in cleaning solvents, cross-contamination from other connectors, buffer gels, cellulose wipes and more. Most often, halos appear with the use of an IPA solution, which seems true particularly when this and other solvents are used excessively. The behavior of a halo is similar to the capillary effect surface tension phenomenon. As such, a liquid tends to minimize exposed surface area exposure to an ambient environment.

Capillary Effect

Defined as the ability of a surface solid to draw a liquid upwards against the force of gravity, these effects occur when the forces (affinity) between the liquid and a solid are stronger than the cohesive intermolecular forces within the liquid, causing a concave meniscus to form where the liquid is in surface contact. This effect also causes porous materials to absorb liquids.

Halo Creation

When fiber optic end faces are joined, the convex curve creates a circular crevice which appears as a ring-shaped gap. Liquid will naturally be pulled from the surfaces within this connection to the circular gap, also referred to as a halo zone. Surface tension dictates how deeply the water will penetrate the crevice.

Residual IPA and other solvents are common culprits. Often improperly stored and handled, these solvents can easily become contaminated. Used in excessive quantities, the liquid penetrates all areas of the connector and is difficult to remove, creating the conditions which give a halo the potential to form.

Halo Prevention

There are several simple steps to halo prevention, beyond removal of all residual cleaning solvent from the surface once it has been used.

1. Use a cleaning solvent with broad solubility, low alcohol content and a fast evaporation rate.
2. Lint-free synthetic or synthetic blend wipes should be used to apply the cleaning solution.
3. If it is necessary to clean an end face mounted in a backplane, use an appropriately sized swab.
4. Employ a wet-to-dry cleaning technique to ensure a dry, clean, contaminate-free end-face.

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