

New UV optical fiber with stable transmission, FD Series Optical Fibers

A new UV all silica optical fiber from Polymicro Technologies exhibits very stable UV transmission. A stable lightguide is a requirement in a broad array of UV fiber optic applications in the wavelength range from <190nm to 300nm. Many spectroscopy (absorption, fluorescence), process control and optical sensing, applications fall into this category.

All silica fibers with high-OH silica cores are traditionally used in applications within the UV-region of the spectrum. In these fibers, the limitations for UV light transmission are the intrinsic attenuation (in dB/m) and additional losses (in dB) due to UV-defects. The intrinsic attenuation is given by Rayleigh-scattering, electronic transitions and a non-structured OH-absorption tail below 200 nm. Figure 1 shows the typical UV spectral attenuation curve for the new FDP series optical fiber (FDP100110125) approaching the theoretical loss curve. Adding to the intrinsic loss are the UV-defects resulting from the breaking of strained bonds under UV- or Gamma-irradiation leading to the appearance of non-bridging oxygen hole-centers (NBOH) " $\equiv \text{Si} - \text{O}^\bullet$ " and E'-centers " $\equiv \text{Si}^\bullet$ " with the corresponding absorption bands at 265 nm and 214 nm. These defects can be reduced by preform material selection, various preform and/or fiber treatments. Polymicro's new FD fiber begins as a reduced defect material with the remaining UV-defects being passivated using a proprietary process yielding a very optically stable UV fiber. Figure 2 shows the huge improvement in UV induced losses for 100um fibers; starting with the standard high-OH UV fiber (FVP Series), a high-OH fiber with a modified core the UVM series offers a respectable 68% improvement, and the new FD fiber with an 89% improvement as compared to the standard high-OH (FVP) fiber.

Due to improvements in fiber treatments and preform modifications the wavelength region below 230 nm can be transparent, even during UV-irradiation. However, due to the strong absorption of the E'-centers at 214 nm, the standard high-OH UV-fibers (FVP Series) can only be used in applications above approximately 230 nm. While the FD Series fibers exhibit useful transmission below 190nm.

Figure 3 shows an example of the FDP stability under UV light "on" and light "off" conditions. The FDP fiber shows very stable output after the light is turned off, while the UVM fiber shows a recovery period during the light "off" condition resulting in an unstable light loss situation.

The FDP UV optical fibers offer superior optical performance over presently available UV fibers in the region below 230nm.

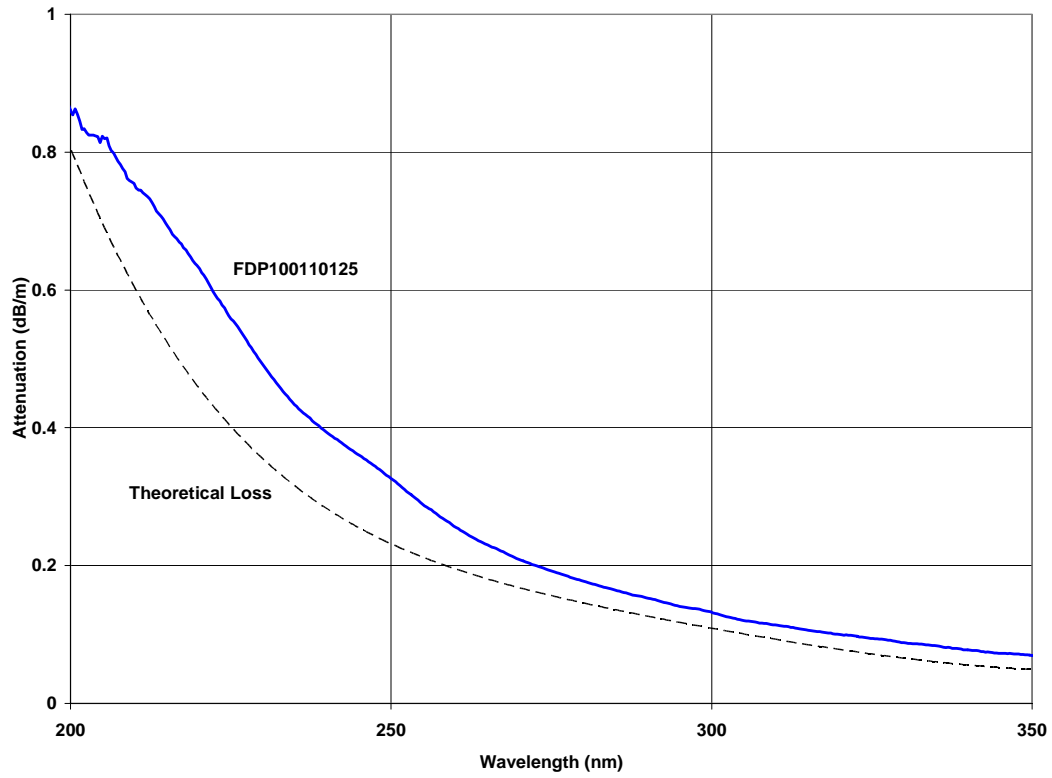


Figure 1 Intrinsic UV Attenuation FDP100110125 fiber with theoretical loss curve

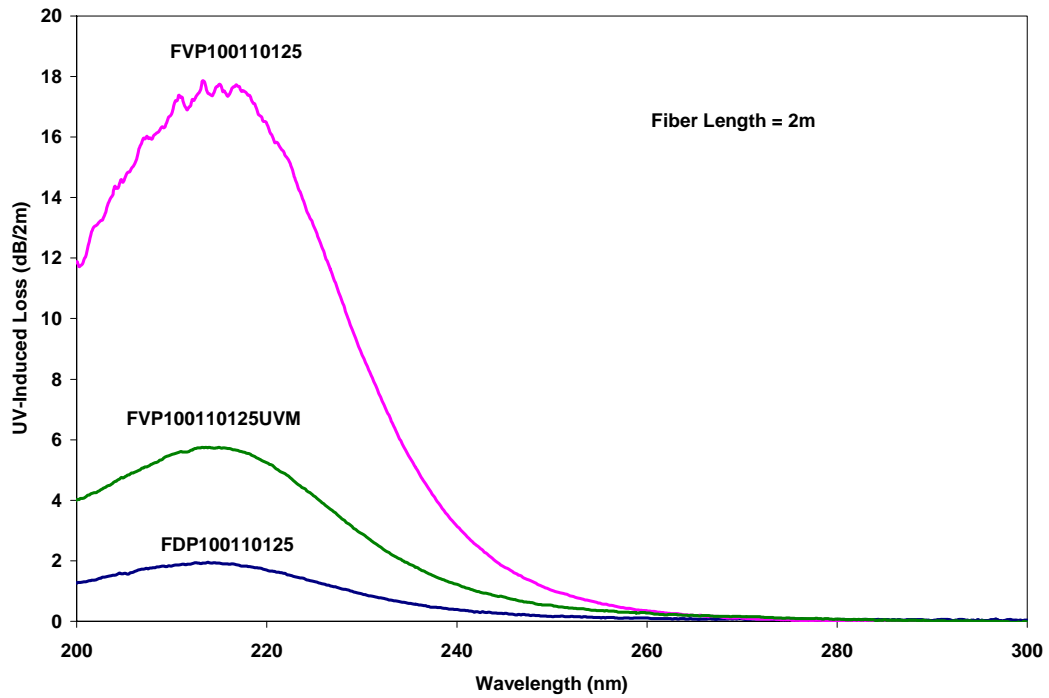


Figure 2 Induced UV-loss for 100um core – FVP Standard High-OH, UVM and new FDP fibers

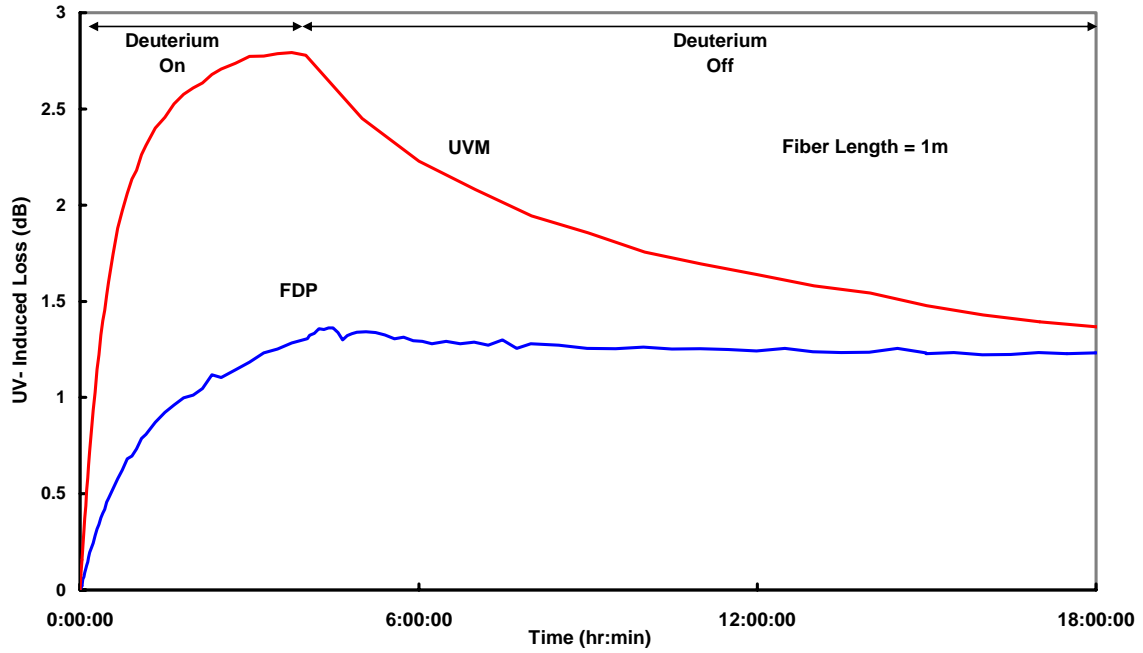


Figure 3 - Temporal behavior of UV-induced loss at 215 nm of UVM fiber and new FDP fiber; light “on”, from 0 to 4 hours; light “off”, from 4 hours to the end

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