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Radiation Performance of GyroSil® Rad-Hard PM Optical Fiber

The GyroSil Rad-Hard PM Optical Fiber has been radiation tested by gamma radiation from a ^{60}Co gamma source, at two different dose rates 1 rad/s and 133 rad/s (100 rad/s = 1 Gy/s), and total dose values are 100 krad and 1 Mrad [1]. Radiation induced attenuation (RIA) at 1550 nm for the two dose rates up to a 100 krad total dose followed by 500 hour annealing at 35°C is depicted in figure 1.

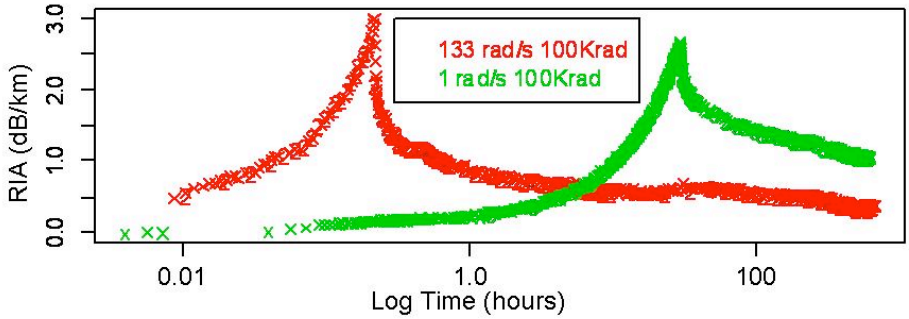

Figure 1. Radiation induced attenuation at 1550 nm for 1 rad/s (green) and 133 rad/s (red) dose rates up to a total dose of 100 krad followed by 500 hour annealing at 35°C.

The data allows for analyzing the radiation induced damage in optical fibers [1,2]. For the GyroSil fiber the RIA is plotted against total accumulated dose at a dose rate of 1 rad/s in figure 2. Comparison is made with SMF28® [3] and the pure silica core Z-fiber® [4]. The later being considered a very radiation hard fiber. This clearly evidence that the GyroSil is a Rad-Hard fiber.

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[1] T. Geisler et al, “Radiation Performance of Low Bend-Loss Optical Fiber for Gyroscope Applications” IEEE/ION PLANS Conference, Monterey, California (2014)
[2] M. LuValle et al., “Radiation Induced Loss Predictions for Pure Silica Core Polarization Maintaining Fibers”, SPIE 6193-50 (2006).
[3] M. Alam et al, “Passive and active optical fibers for space and terrestrial applications”, Proc. SPIE, Vol. 6308 (2006)
[4] Data from EPFL Space Center
[5] M. Poizat, “Space Environment and effects”, (2009).

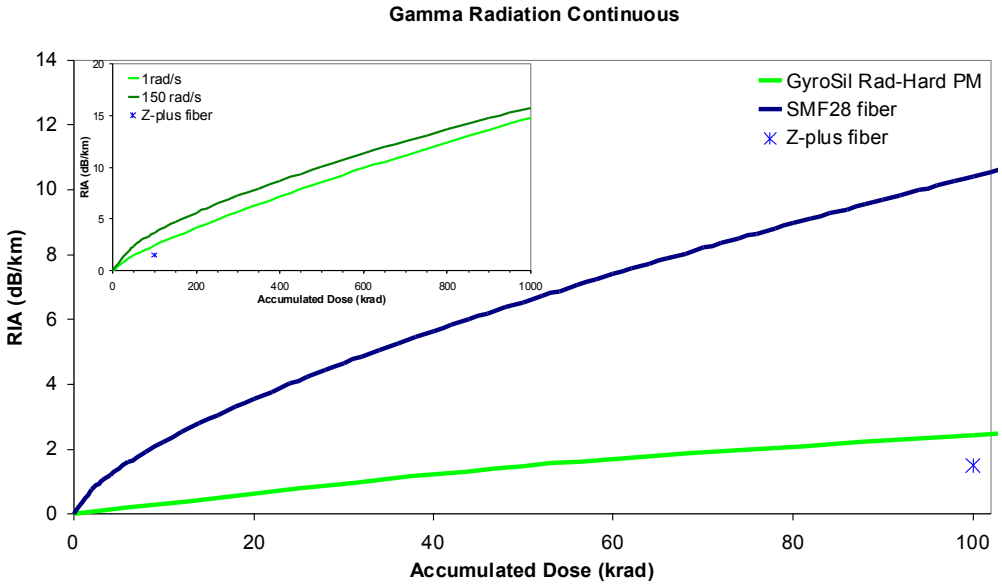

Figure 2. Radiation induced attenuation at 1550 nm versus accumulated dose of gamma radiation at a dose rate of 1 rad/s. The GyroSil Rad-Hard is compared with SMF28® [3] and the pure silica core Z-fiber® [4]. Inset shows the RIA at 1 rad/s and 150 rad/s dose rates up to an accumulated dose of 1 Mrad.

The simulated RIA over a 15 year geosynchronous orbit is shown in figure 3.

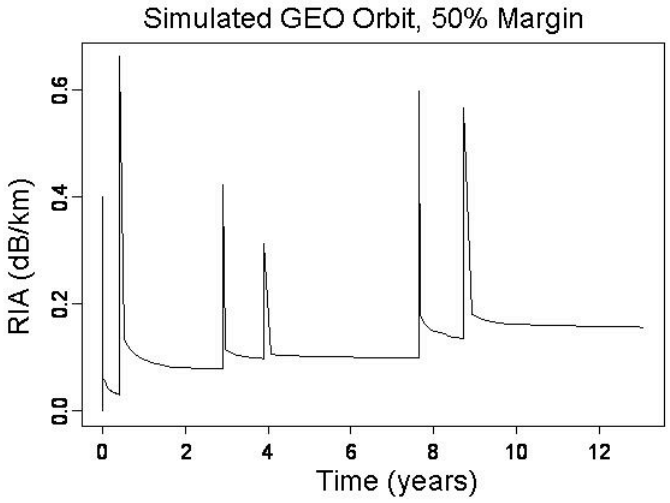

Figure 3. Radiation induced attenuation at 1550 nm versus time in a geosynchronous orbit. Flares were simulated assuming 4 major flares per decade with a total exposure of 60 krad (50% more than assumed from standard exposure with 20 mm Al shielding in a GEO [5]).