Università degli Studi di Cagliari

Dipartimento di Fisica

Visiting Professor 2013

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First Lecture (28.05.2013)

Radiation effects in silica-based optical fibers: a review

S. Girard, University of Saint-Etienne, Hubert Curien Labs., F42000, France

This presentation will review the advantages and limitations for the integration of optical fibers and optical fiber sensors in nuclear environments [1]. If fibers present key advantages for use in such harsh conditions, it is now well established that radiations lead to changes in their optical properties, reducing their transmission capability for example. The main microscopic mechanisms leading to the degradation of the macroscopic optical properties of these amorphous silica-based waveguides under irradiation will be discussed. The intrinsic and extrinsic parameters impacting the amplitudes and kinetics of these changes will be presented. Based on the current research activities in University of Saint-Etienne, examples will be given to highlight how these effects limits the use of fiber optics for different applications in various radiation environments like in space, in high energy physics, or in the facilities devoted to the fusion understanding.

[1] Girard, S.; Ouerdane, Y.; Boukenter, A.; Marcandella, C.; Bisutti, J.; Baggio, J.; Meunier, J. -P, "Integration of Optical Fibers in Megajoule Class Laser Environments: Advantages and Limitations," *Nuclear Science, IEEE Transactions on* , vol.59, no.4, pp.1317,1322, Aug. 2012

Second Lecture (30.05.2013)

Radiation effects in silica-based optical fibers: hardening techniques and future challenges

S. Girard, University of Saint-Etienne, Hubert Curien Labs., F42000, France

In the first part of this presentation, the different hardening-by-components or hardening-by-systems techniques that are used in Saint-Etienne to improve the radiation tolerance (hardness) of the optical fibers will be reviewed. We will present the possible ways to enhance the fiber hardness with appropriate choices for the compositions of the glass or by using pre- or post-treatments on the fibers to reduce the amplitudes or change the kinetics of the radiation-induced changes. In a second part, the coupled simulation/experiments approach developed at the Labs in collaboration with

numerous European Labs will be detailed providing evidence of our advances in the building of a prediction tool of the radiation-induced effects in optical fibers and fiber sensors. Finally, some of the future challenges to be overcome by our radiation effects community will be presented.

[1] Girard, S.; Kuhnhenn, J.; Gusarov, A.; Brichard, B.; Van Uffelen, M.; Ouerdane, Y.; Boukenter, A.; Marcandella, C., "Radiation Effects on Silica-Based Optical Fibers: Recent Advances and Future Challenges," Nuclear Science, IEEE Transactions on , invited paper, to appear June 2013.