Coupling experiments and simulations for the radiation hardening of fiber optics: (I) Experimental results on canonical samples of pure and doped silica

N. Richard[1], S. Girard[1], L. Martin-Samos[2], Y. Ouerdane[3], A. Boukenter[3], J.-P. Meunier[3]

[1]*CEA, DAM, DIF, F91297 Arpajon, France*
[2]*CNR-IOM, DEMOCRITOS, via Bonomea 265 34136 Trieste, Italy*
[3]*Laboratoire Hubert Curien, UniversitÃl' de Saint-Etienne, UMR-CNRS 5516, 42000 Saint-Etienne, France*

Silica-based glasses and fibers are considered for use in future facilities associated with very extreme radiative environments like ITER, LMJ, IFMIF, ...For such applications, optical fibers have strong advantages but their integration remains limited by the increase of their linear attenuation observed under irradiation (Radiation-Induced Attenuation). This macroscopic degradation is due to radiation-induced changes at the microscopic level: the generation of point defects in the silica glass of the fiber core and cladding. A predictive model appears necessary to design radiation-hardened fibers and glasses to these challenging environments. The codes necessary for such a prediction are still under development (abstract II by Richard) and need dedicated experimental data allowing the comparison between the simulation results ant the experimental results obtained on comparable samples. We will discuss the approach that we put in place in collaboration between our 4 labs and that is based on the development of specific samples of glasses and fibers (canonical samples), directly comparable to our simulation cells and designed to highlight the impact of one composition or process parameter on the point defects generation. A review of our more recent results based on the spectroscopic analysis (absorption, luminescence, ESR,...) on these canonical samples will be presented.