Glasses under irradiation

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Glasses under irradiation concerns a large range of applications from nuclear industry to space (nuclear glasses, optical fibers). It thus includes the glass aging under radiative environment or the monitoring of glass properties by irradiation (induced by UV or fs laser for example).

In this talk, after a general overview on these topics, we will focus on the relaxation of silica glasses under electron irradiation (structure and density). Silica is omnipresent in nature being a constituent of the earth mantle and in technology. Silica-based glasses provide the backbone of many of nowadays rapidly expanding photonics applications, which disserve diverse fields such as optical communications, electronics, sensor technologies, medicine, and materials processing. Due to a large free volume, densification in silica can reach 21 % by applying hydroscopic high pressure (typ. 25 GPa at room temperature) whereas under irradiation (neutrons, electrons, ions, ..), a maximum densification of 4-5% can be obtained[1]. We have recently shown that a unique phase of silica characterized by a 2.26 g/cm^3 density can be obtained after 11 GGy of dose whatever the initial structure of silica[2]. This silica phase display intense D_1 and D_2 bands in its Raman spectrum, identically to the "metamict phase" obtained from quartz amorphization[3] under fast neutrons irradiation. We will in addition discuss the formation of molecular oxygen under irradiation in the free volume of the densified silica glasses analyzed by using *in situ* cathodoluminescence on SIRIUS electron accelerator.

Finally, some results concerning the radiation (electron and fs-laser) induced modifying luminescence properties of Eu-doped phosphate glasses will be given.

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