Europium environment modification by electron irradiation in phosphate glasses

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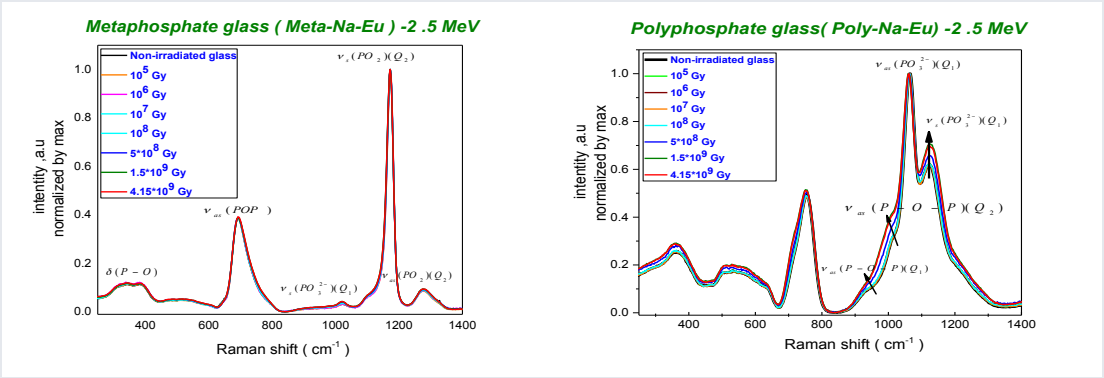
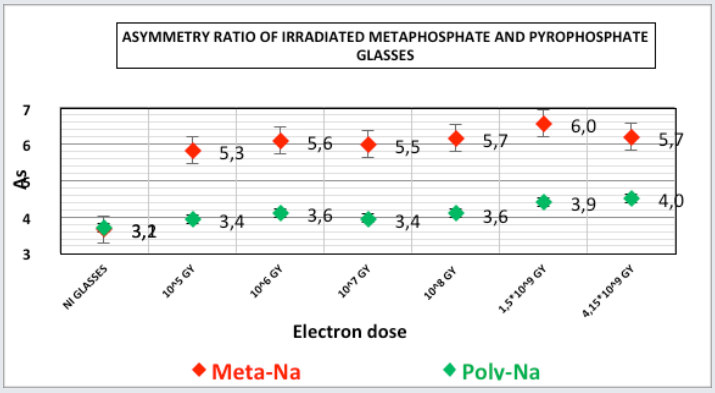
Phosphate glasses present a lot of advantages for optical applications mainly due to the high content of Rare Earth (RE) ions that can be incorporated in their network. In this PhD work, we investigate the possibility to control the Eu^{3+} environment in different metaphosphate and polyphosphate glass compositions under irradiation. We study the mechanism leading to the evolution of the glass by comparing the impact of High energy electron and fs laser. Using SIRIUS Accelerator, glasses were irradiated with electrons of 2.5 MeV at various doses. We observe in figure 1 that there is no important change of the metaphosphate glass structure whatever the integrated dose contrary to polyphosphate glasses that show significant change (glass depolymerization) of the vitreous network from 108Gy.



Raman spectra of Na-Eu metaphosphate glasses (left) and Na-Eu polyphosphate glasses (right) according to the irradiation dose (2.5 MeV electrons)

The evolution of the Eu^{3+} ion environment is studied by photoluminescence. One measured parameter is the asymmetry ratio A_S = 5D_0→7F_2 (Forced electric dipole) / 5D_0→7F_1 (Magnetic dipole): sensitive to characterize the deviation and the distortion of the site symmetry. The figure 2 displays an important increase of the asymmetry ratio in metaphosphate glasses with the irradiation dose and a moderate one in polyphosphate glasses. It shows that the local site symmetry of the ion is disconnected to the network variation even if in both types of glasses an additional reduction of Eu^{3+} into Eu^{2+} under irradiation is observed.



Asymmetry ratio of Eu3+ in Na metaphosphate glasses (red) and Na-polyphosphate glasses (green) as a function of the irradiation dose (2.5 MeV electrons)

Résultats obtenus dans le cadre du projet REMI financé par le thème émergence du LabEx PALM et porté par Nadège Ollier et Kees Van Der Beek (LSI, EP)

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