THESIS DEFENSE
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Eu^{3+} ion environment modification by Electron and femtosecond laser irradiation in metaphosphate and polyphosphate glasses

Rare Earth (RE) doped phosphate glasses are attractive materials in optic due to their low glass transition temperature and their high ability to dissolve rare earth ions compared to silicate glasses. In this work, we are interested in understanding the mechanisms leading to the structural modification of zinc polyphosphate and metaphosphate glasses under irradiation with the aim of controlling the environment of rare earth ions (in particular Eu^{3+} ions) by irradiation. We compared the effects obtained under electron and femtosecond laser irradiation by varying the dose and electron energy (700 keV and 2.5 MeV), the laser repetition rate as well as the glass compositions that contain different alkaline and alkaline earth ions (Na, Li, K and Mg) and Zn contents.

We have demonstrated the decrease of the Eu^{3+} site symmetry, the increase of the sites dispersion as well as an effective reduction of Eu^{3+} to Eu^{2+} under electron irradiation.

The presence of Zn attenuates the variation of the local order around the rare earth, while the vitreous network is less stable under irradiation. The formation of Eu^{2+} ions (under two types of high and low symmetry environments) is further enhanced in the presence of Zn and using 700 keV electrons. The femtosecond laser at 10 KHz gives causes crystallization of metaphosphate glasses without reduction of Eu^{3+} ions.

Keywords: Europium, Phosphate glasses, Electron irradiation, femtosecond laser, Molecular dynamics simulation

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