

Supplementary Information

I Raman spectra

Figures SI1 – SI5 present the Raman spectra for the NBO2, NBO4, NBO5, Si/Al 5.4 and Si/Al 1.3 pristine and irradiated glasses. The intensities are given in arbitrary units and normalized at the spectra surfaces for all the spectra.

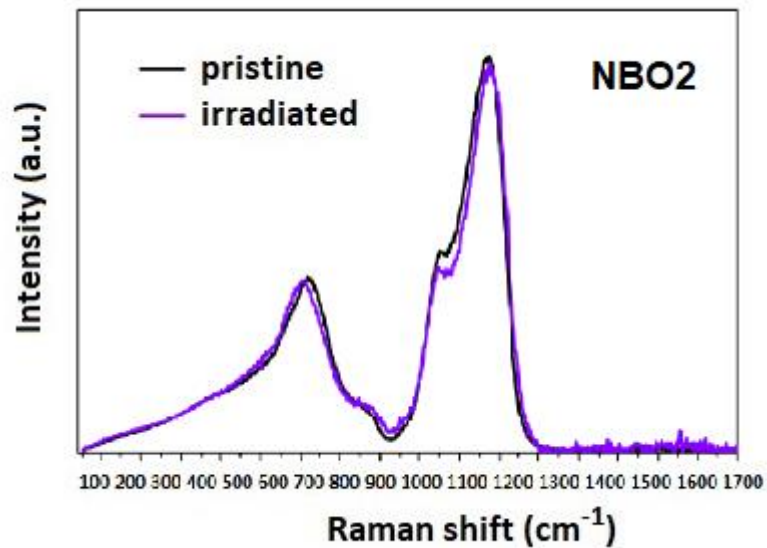


Figure SI1: Raman spectra for the pristine and irradiated NBO2 glass.

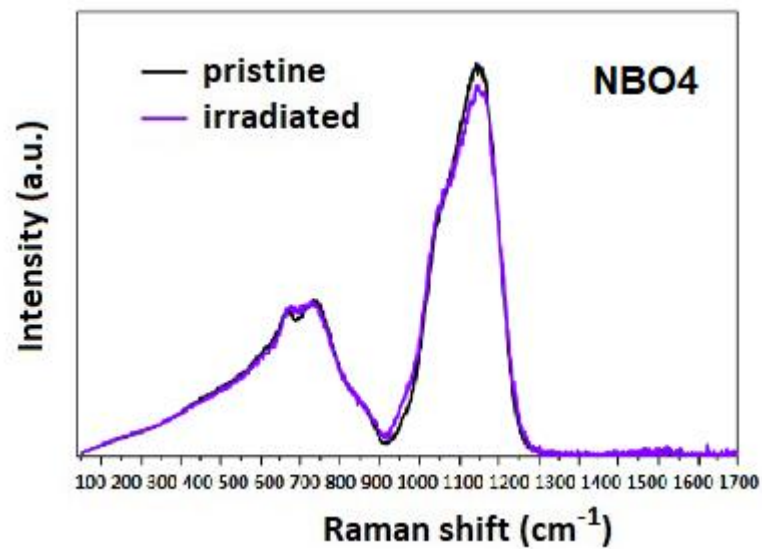


Figure SI2: Raman spectra for the pristine and irradiated NBO4 glass.

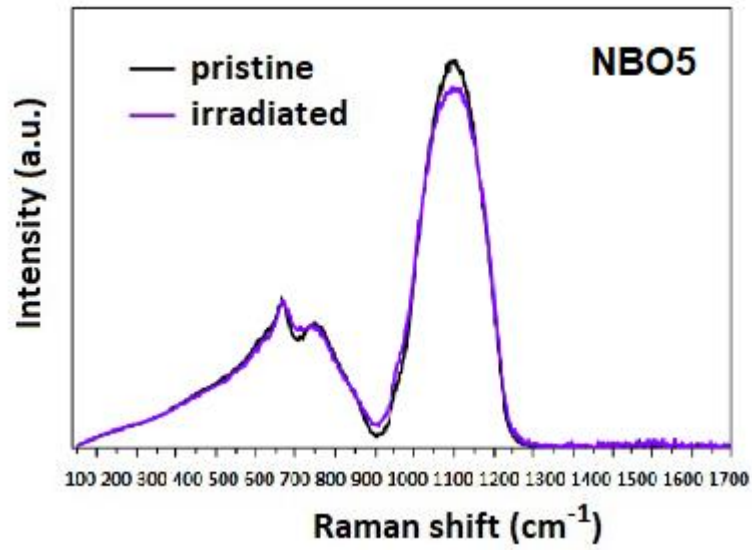


Figure S13: Raman spectra for the pristine and irradiated NBO5 glass.

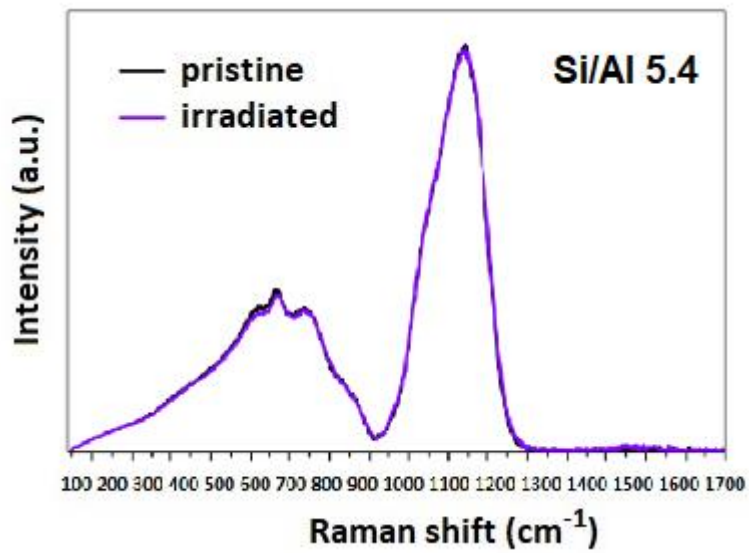


Figure S14: Raman spectra for the pristine and irradiated Si/Al 5.4 glass.

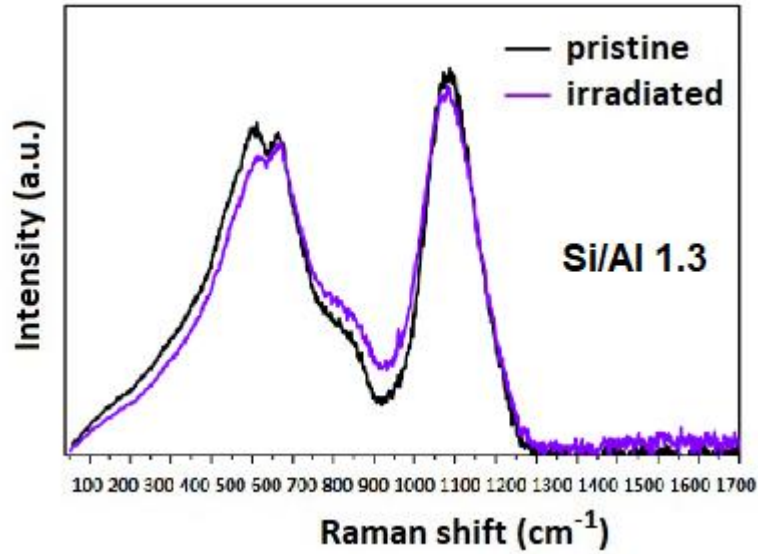
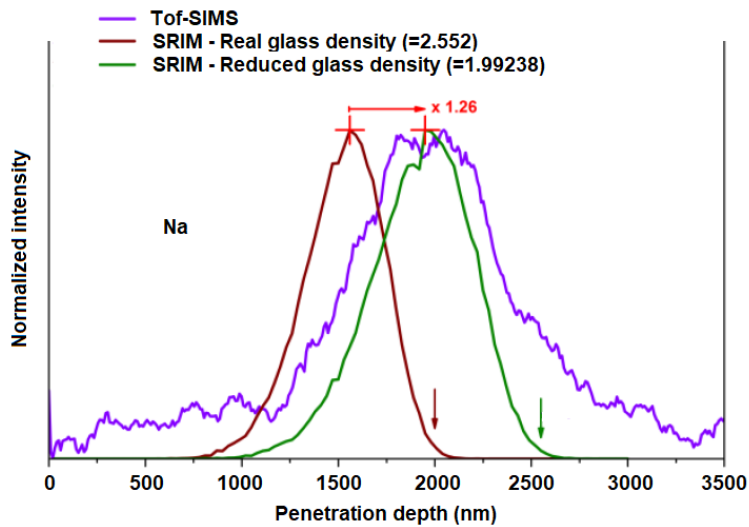


Figure S15: Raman spectra for the pristine and irradiated Si/Al 1.3 glass.

II Penetration depth of the Au ions measured by TOF-SIMS and estimated by SRIM

The penetration depth of the Au ions has been measured by TOF-SIMS and estimated by SRIM for the Na and Na/Ca 1.4 glasses. SRIM calculations underestimate the real penetration depth. To find the real values, it is necessary to consider a lower glass density as shown on Figure S16.



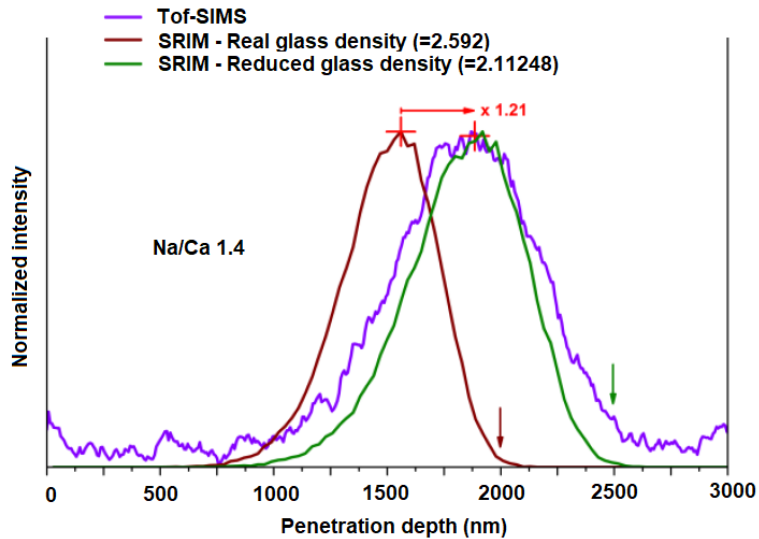
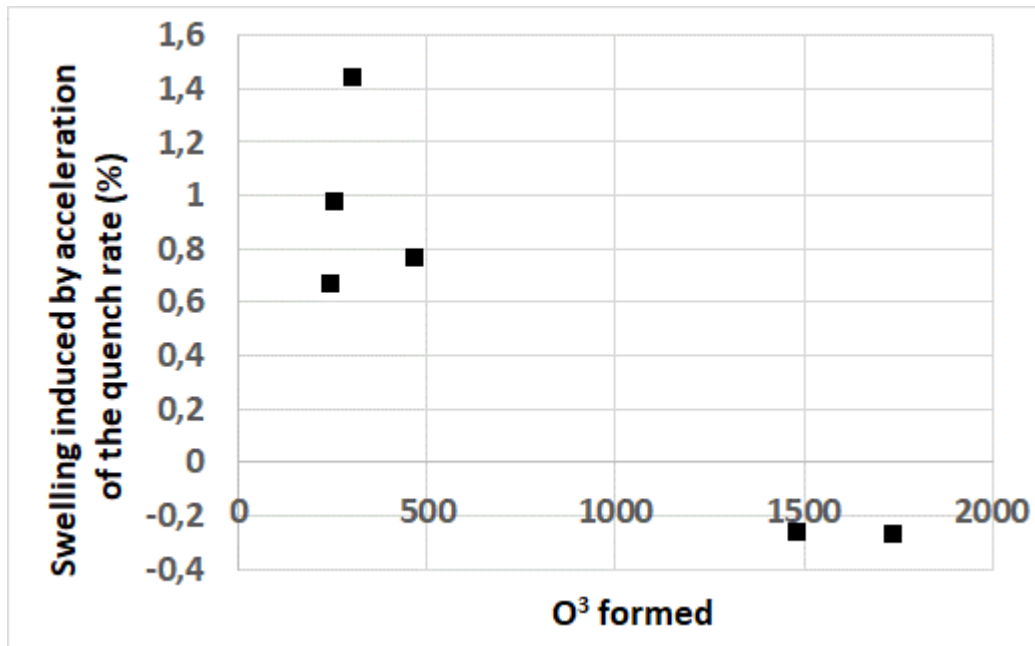


Figure S16: Penetration depth for the Au ions in the Na (top) and Na/Ca 1.4 (bottom) glasses. Tof-SIMS profiles are in blue. SRIM calculations using the real glass densities are in brown. SRIM calculations using reduced glass densities are in green. The brown and green arrows indicate the end of the Au ion trackings.

III Volume change versus the quantities of O^3 and Al^5 formed by accelerating the quench rate

By accelerating the quench rate from $10^{12}K/s$ to $10^{15}K/s$ to fabricate the glasses, density changes as well as the quantities of three coordinated O (O^3) and five coordinated Al (Al^5). The density change is plotted versus the quantities of O^3 and Al^5 formed on Figure S17. It is shown that increasing the O^3 and Al^5 concentrations limit the swelling.



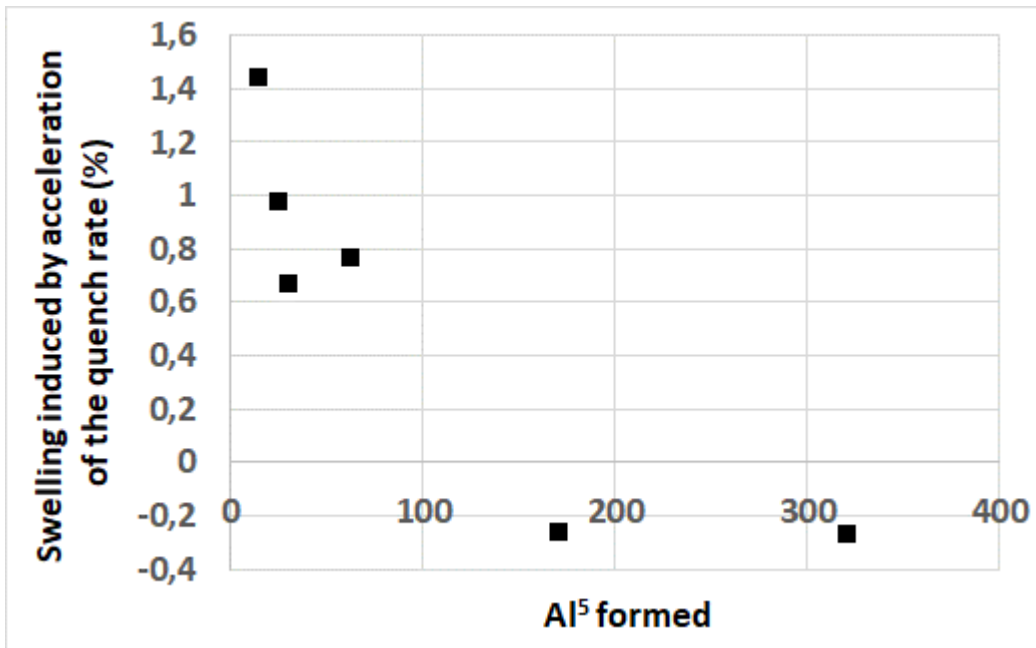


Figure S17: Volume change versus the quantities of O³ and Al⁴ formed by accelerating the quench rate.