Time Resolved Fluorescence of Framework Silicates

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We will describe the development of the new Time Resolved X-ray Excited Optical Luminescence (TR-XEOL) facility at the i18 microfocus beamline at the Diamond Light source. This new facility allows the comparison of time resolved luminescence data collected to be compared with data collected from Photoluminescence (PL) and cathodoluminescence excitation. The presentation shows results from luminescent centres in the blue and ultra-violet regions from a number of framework silicates including feldspar, quartz and sodalite. Our results show differences between XEOL Photoluminescence and Cathodoluminescence spectra which provide insights into the physical nature of the centres causing the light emitted.
We show lifetime measurements for UV and blue centres XEOL. Many samples show differences in the lifetime between pulsed laser and pulsed X-ray excitation with the X-ray excitation showing significant variations in decay lifetimes. Samples typically can display a doubling of the value of the shortest lifetime component. We hypothesise that the differences in the lifetimes of the emissions probe the nature of the absorption and energy transfer mechanism within the mineral. The luminescence signal can be analysed both by energy to differentiate between alternative emission pathways and as a time resolved signal to probe the mechanisms involved in absorption, energy transfer, and other factors affecting the relaxation lifetimes. We make preliminary inferences on the physical nature of the centres involved in UV-blue luminescence in framework silicates. Fig 1 shows a TR XEOL spectra collected at 400nm from RT51 a single crystal Anorthite feldspar Alaska (Smithsonian Institute) fitted with a single exponential decay of just over 1ns. We will also discuss the potential for TR optically detected XAS.