

Time resolved luminescence of framework silicates

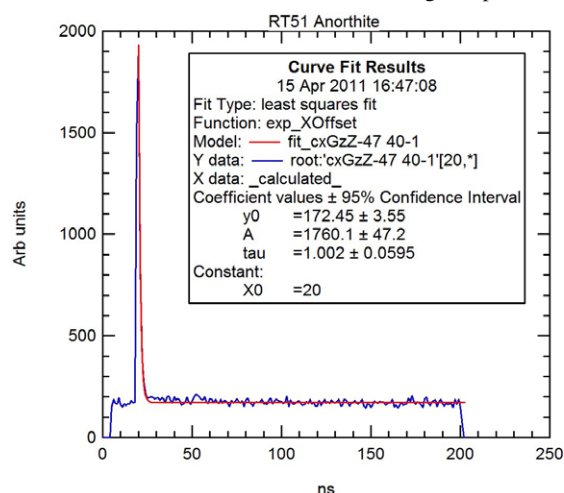
R.P. TAYLOR^{1,2*}, J.F.W. MOSSELMANS¹, A.A. FINCH²
AND P.D. QUINN¹

¹Diamond Light Source, Didcot, OX11 0DE, UK
(*correspondence: rpt5@st-andrews.ac.uk)

²Dept. of Earth Sciences, St Andrews, KY16 9AL, UK
(aaf1@st-andrews.ac.uk)

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 allows the comparison of time resolved luminescence data collected at this facility 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 increases in decay lifetimes. Samples typically 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 XEOL spectra from RT51 a single crystal Anorthite feldspar Alaska (Smithsonian Institute) fitted with a single exponential.



Calculated stability of osumilite, sapphirine and biotite in K₂O-FeO-MgO-Al₂O₃-SiO₂-H₂O-TiO₂-O (KFMASHTO)

K. TAYLOR-JONES^{1*}, R. POWELL² AND T.J.B. HOLLAND¹

¹Department of Earth Sciences, University of Cambridge, Cambridge, CB2 3EQ, United Kingdom
(*correspondence: kat32@cam.ac.uk)

²School of Earth Sciences, University of Melbourne, Victoria 3010, Australia.

With the advent of the new Holland & Powell internally-consistent thermodynamic dataset [1], in the form of the initial release of the dataset (tc-ds61.txt) on <http://www.esc.cam.ac.uk/people/academic-staff/tim-holland>, and <http://www.metamorph.geo.uni-mainz.de/thermocalc/>, calculation of the stability of osumilite, sapphirine and biotite can be undertaken in a much improved way. This has necessitated the development of new activity-composition (a-x) relations for the minerals as the underpinning relationships from the dataset generation have changed, as well as recognition of shortcomings in earlier models. The osumilite a-x model is a major reworking of the previously used one. The sapphirine a-x model is built on our recent work [2], with changes relating to the way sapphirine end-members are now incorporated in the dataset. Dataset annite, and the attendant a-x model for biotite, takes account of the fact that 'annite' in experiments contains significant ferric iron. We present calculated pressure-temperature projections (petrogenetic grids) for quartz-saturated systems at high and ultrahigh temperature crustal conditions in K₂O-FeO-MgO-Al₂O₃-SiO₂-H₂O (KFMASH), K₂O-FeO-MgO-Al₂O₃-SiO₂-H₂O-O (KFMASHO), and K₂O-FeO-MgO-Al₂O₃-SiO₂-H₂O-TiO₂-O (KFMASHTO), and calculated compatibility diagrams, to illustrate the phase equilibria.

[1] Holland & Powell (2011) *Journal of Metamorphic Geology* **29**, 333-383. [2] (2010) *Journal of Metamorphic Geology* **28**, 615-633.