Vacuum Ultraviolet photo-conductivity studies of doped luminescent materials using Synchrotron Radiation.

E. van der Kolk[1], S.A. Basun[2], W.M. Yen[1], P. Dorenbos[3], C.W.E van Eijk[3]
[1] Department of Physics and Astronomy, University of Georgia, Athens, Georgia, USA.
[2] A.F. Ioffe Physico-Technical Institute, St. Petersburg, Russia.
[3] Delft University of technology, Interfaculty Reactor Institute, Delft, The Netherlands

Persistent photo-conductivity (PC) has proven to be useful in the study of photo-ionization and electron delocalization processes in scintillator and phosphor materials [1-3]. Of particular interest is the energy of ground- and excited states of luminescence centers relative to the host conduction and valence bands. In some cases accurate energy values can be found by a temperature dependent photoconductivity study (see Fig.1). In this contribution the focus will be on the temperature dependent photo-conductivity of single $Ln_2SiO_5:Re^{3+}$ crystals (Ln=Lu,Y; Re=Ce, Pr).

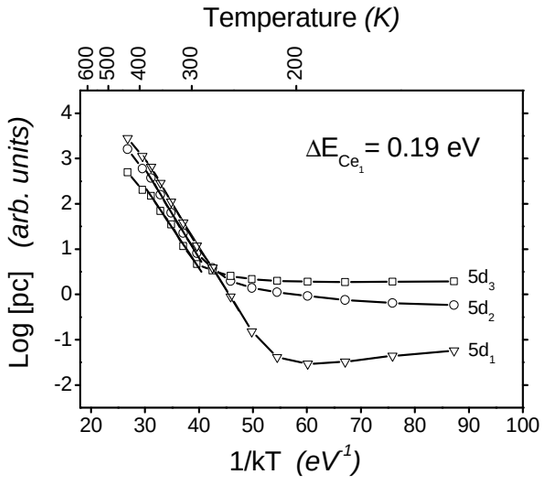

Fig. 1: *A Photo-cunductivity Arrhenius plot of the Ce^{3+} 5d state intensities in Lu_2SiO_5 reveals a thermal ionization barrier of 0.19 eV. This energy value may be interpreted as the position of the emitting Ce^{3+} 5d state below the CB-edge.*

The recent focus on Vacuum Ultraviolet (VUV) and quantum cutting phosphor systems [4,5] requires a shift of the current experimental upper energy limit of photo-conductivity experiments into the VUV spectral region. We take this opportunity to report on our recent attempts to expand PC measurements into the VUV using synchrotron radiation. It was found that the unwanted currents due to photo-emitted electrons from the Nickel mesh electrodes could be avoided by using a 0.1 nm metal film instead. This work was supported by a grant from NSF.

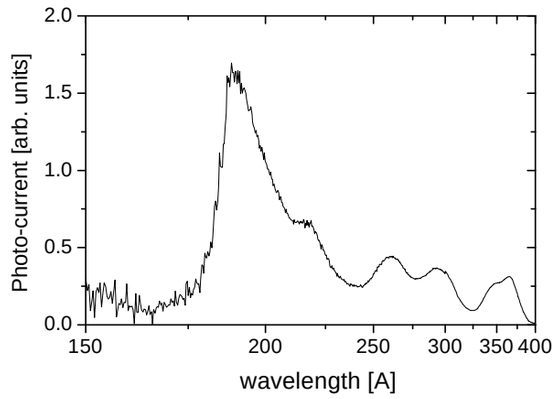

Fig. 2*: The first PC trace, using synchrotron radiation, revealed that the photo-conductivity responds of Lu_2SiO_5 drops to zero at energies above E-gap.*

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