ESRF	**Experiment title:** "GENERATION OF DEFECTS AND LUMINESCENCE IN BROMIDES BY NEAR-EDGE X- RAYS."	**Experiment number:** HC-36
Beamline: ID1l-BL2	**Date of Experiment:** from: 01 DECEMBRE 1994 to: 03 DECEMBRE 1994	**Date of Report:** JULY 18th, 1994
Shifts: 6	**Local contact(s):** W. SCHWEGLE	*Received at ESRF:*

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Report:

The alkali halides are readily damaged by ionizing radiations [1] via the creation and subsequent trapping of electron-hole pairs on lattice sites (the Self-Trapped Excitors, STE). The STE has two recombination modes: radiative (emission of Stokes-shifted luminescence only at Iow temperatures), and non-radiative (with formation of F-H defect pairs). In X-ray irradiated NaBr (class I) at 20K, the STE radiative recombination mode dominates. In KBr (class II) at low temperatures, both the luminescence emission and the defect formation are observed. This work investigates the processes of luminescence and of defect creation after ignition of the anion K-shell excitation. The electronic relaxation of the anion, following the initial inner-shell hole, leaves an anion with a high positive charge state and produces high-energy photo-electrons and Auger electrons responsible for further ionizations along their diffusion paths. The K-shell ionized halogen produces a local high density of ionizations, susceptible to affect the net balance of F-defect formation [2-5].

In this experiment, single crystals of NaBr and KBr were submitted to a monochromatic X-ray beam tuned through the bromine K-edge (13.5 keV) at BL2 (ID 11). The yield of F-centre generation at 20K and 200K was measured in situ by optical absorption spectrometry. The emission yield of the STE luminescence at 20K was recorded simultaneously with the 12 keV X-ray fluorescence.

Fig. 1 shows a (18*2)% decrease of the intensity of KBr luminescence at 20K when the photon energy is scanned across the bromine K-edge. We calculate that the absorbed energy is decreased by 13% above the K-edge, due to the $K_{\alpha,\beta}$ fluorescence radiative loss. The luminescence yield is thus approximately constant across the K-edge.

Fig. 2 shows the F defect concentration (cm^{-2}) as a function of the dose of the incident X-rays (eV/cm^2) for NaBr at 200K. We observe a ~15% decrease of the F coloration efficiency (defect concentration per absorbed dose in F/eV) above the Br K-edge. This result is in contradiction with the 8-fold increase of the F coloration through the Br K-edge, observed by Sever et al [4].

When the photon energy exceeds the K-shell absorption edge, no F defect could be observed in NaBr at 20K, even at high doses. By comparison, an unusual presence of F-defects was observed in NaBr at 20K under swift heavy ion irradiation, attributed to the high density of ionizations in the ion track [6].

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Fig. 1 : KBr luminescence (20K)

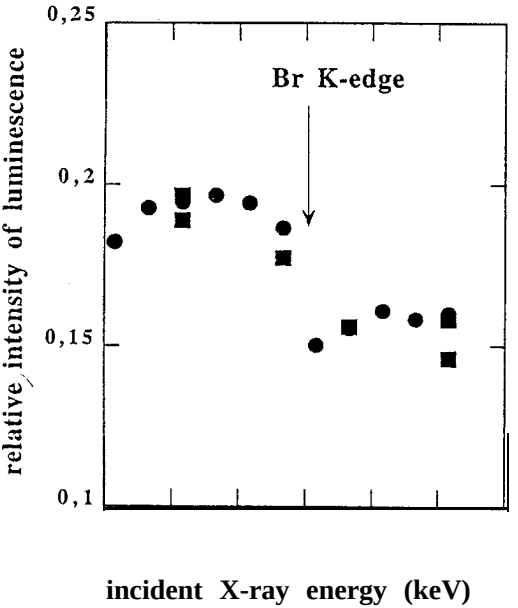

Fig. 2 : F growth (NaBr, 200K)