REE^{3+} µ-luminescence spectroscopy used to quantify and visualize radiation damage accumulation – First results of a heavy ion-irradiation study

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Here, we present first results of a heavy-ion (Au) irradiation-study of the important nuclear waste-form matrices zircon ($ZrSiO_4$), xenotime-(Y) (YPO_4) and zirconolite ($CaZrTi_2O_7$). Bulk, poly-crystalline ceramics were irradiated with accelerated heavy ions (Au) with energies up to 35 MeV. We use surface-sensitive, grazing-incident X-ray diffraction of irradiated bulk ceramic pellets for the estimation of the amorphous fraction produced and demonstrate how photo- (PL) and cathodoluminescence (CL) spectroscopy may be used as a tool for the characterisation and quantification of irradiation-induced structural damage in nuclear waste-form materials on a µm-scale.

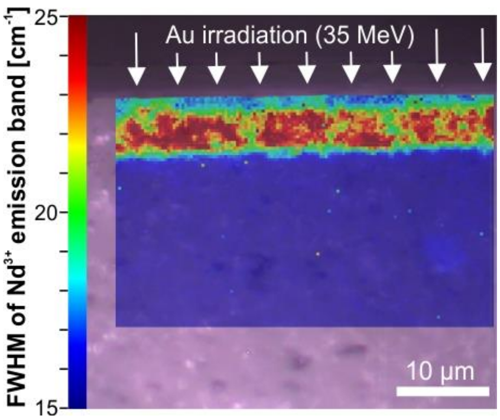

Figure 1. Optical-microscope image and PL map of an Au-irradiated (35 MeV) zircon ceramic (prepared as orthogonal section). The superposed, colour-coded PL map shows the distribution of Nd^{3+} band widths across the sample. Increased band-widths indicate accumulation of structural radiation damage due to heavy-ion irradiation.

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