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Cross-relaxation quenching of x-ray excited luminescence in Eu-activated phosphors JOSEPH PACOLD, Lawrence Berkeley National Laboratory, DEVON MORTENSEN, University of Washington, WILLIAM REICHLIN, Central Washington University, ZOU FINFROCK, Argonne National Laboratory, ANTHONY DIAZ, Central Washington University, GERALD SEIDLER, University of Washington — Compounds, molecules, and nanoparticles containing lanthanides as primary constituents or as dopants are widely used in applications including luminescent dyes and lighting phosphors. Recent work has shown that x-ray spectroscopy methods can be used to monitor the sequence of excited states that leads to luminescence in lanthanide materials. Here, we use x-ray excited optical luminescence (XEOL) to identify a nonradiative process that quenches the emissive excited state of Eu^{3+} in the phosphors YVO_4:Eu^{3+} and YVO_4:Bi^{3+},Eu^{3+}. Taking advantage of the high flux (up to 2×10^{12} photons/second) and focusing capability (beam FWHM 5 μm) of a modern synchrotron beamline, we observe saturation of the XEOL yield at high x-ray flux densities. The saturation effect is interpreted with a kinetic model in which pairs of excited Eu ions undergo an Auger-like cross-relaxation. This effect is well documented in the literature on cathode-ray phosphors, and allows us to estimate the excited fraction of Eu^{3+} ions. We discuss applications of this method to the broader problem of studying energy transfer in luminescent materials, as well as technical implications for future x-ray spectroscopy studies that require high flux.

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