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Band Gap Transition Studies of U:ThO2 Using Cathodoluminescence JOSHUA REDING, Air Force Institute of Technology, DAVID TURNER, Oak Ridge Institute of Science and Education, ROBERT HENGEHOLD, Air Force Institute of Technology — The Department of Defense has an interest in thorium dioxide (ThO_2) and uranium dioxide (UO_2) as possible candidates for use in designing neutron detectors. Three U_x:$Th_{1-x}O_2$ (x= 0.00, 0.01, 0.22) hydrothermally grown single crystals were examined using cathodoluminescence to interrogate the changing electronic properties of ThO_2 as it became an alloy. Both depth-resolved and temperature-dependent cathodoluminescence studies were performed to examine the crystal structure and the defects present. An ultra-high vacuum system operating at 10^{-8} Torr was used with electron beam energies ranging from 2 to 14 keV. Spectra were taken on all three samples before and after a proprietary chemical cleaning process involving a crown ether/picric acid solution was applied to the crystals to remove surface contaminants. Spectral deconvolution of the spectra showed evidence of both direct and indirect gap photon transitions from the O 2p to Th 6d at 4.2 eV and 4.8 eV respectively. Uranium-doped spectra showed evidence of the midgap O 2p to U 5f quadrupole transition and O 2p to U 6d transition at 5 eV.

Robert Hengehold
Air Force Institute of Technology

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