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Analyzing Particle Size Effects in ZnS:Cu using X-ray Absorption Spectroscopy SCOTT MEDLING, M. KOZINA, Y. JIANG, B. BALABAN, F. BRIDGES, S. CARTER, UC Santa Cruz — We report XAS measurements on ZnS:Cu,Mn phosphor materials of various particle sizes, 1-25μm. These materials exhibit electroluminescence (EL) at AC voltages of order 100V for $\sim$25μm particles, but only from small points associated with CuS nanoprecipitates (which form along the 111 plane in ZnS); here the local electric fields are enhanced by a factor of about 100. To enable lower-voltage applications, it is desirable to make smaller particles so devices can be thinner. We investigated the local structure for smaller particles produced by mill-grinding to determine why grinding leads to reduced AC EL. The K-edge EXAFS data show a decreased Cu-S first peak amplitude for the ground particle samples, but little change for Mn-S or Zn-S peaks. The XANES data show a large change in the structure of the Cu K-edge for smaller particles but not for either the host Zn or Mn dopant edges. Clearly grinding affects the environment about Cu, in the CuS precipitates, much more than the ZnS host lattice. Possibly the ZnS particles fracture preferentially through the CuS precipitates or the ZnS particles are partially sheared along the 111 plane.

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