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Quantitative X-ray Absorption Imaging of Density Distributions in HID Lamps JOHN J. CURRY, NIST — Quantitative x-ray absorption imaging of gases is possible with an optical digital array detector, such as a charge-coupled device (CCD), combined with an x-ray phosphor. The linearity and low dark current of a CCD enable the sensitivity needed to image gases quantitatively. X-ray absorption imaging is useful in the high-pressure Hg discharges of HID lamps because Hg has a relatively large x-ray absorption cross-section. However, inversion of a 2-dimensional projected image to obtain a 3-dimensional distribution is not directly solvable when the x-ray source has a broad spectrum and detection is not energy-resolved. Given that the energy-dependent Hg absorption cross-section varies by nearly a factor of 4 over the 15 keV to 25 keV spectral range typical of an x-ray tube source, as much as a factor of 2 error in the measured Hg density can result. The problem is further complicated by the fact that the x-ray spectrum inevitably varies with position in the image because of spectral filtering by the arc tube. A solution of sufficient accuracy can be obtained by determining, *a priori*, an effective absorption cross-section based on the spectral distribution and energy-dependent response of the CCD/phosphor system. Progress on determining such cross-sections for a range of parameters will be presented.

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