Selenide versus sulfide centers on (100) AgIBr surfaces: characterization and energy levels

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Abstract
Sensitometric and spectroscopic techniques are used to characterize sensitizer centers produced by sulfur and selenium sensitization of AgIBr cubes. Sulfur sensitization primarily affects the long-wavelength sensitivity in three spectral regions-550, 700 and 800 nm. For selenium sensitization only the 550 and 800 nm spectral regions were affected, along with a weak effect at 650 nm. The concentration dependence of the long wavelength sensitivity showed the 550 nm region to be associated with single-chalconide centers. The other spectral regions are assumed to be multiple-chalconide species, but concentration-dependent activation energies for long-wavelength sensitivity precluded a more definitive assignment. A prominent 480-490 nm peak is observed in diffuse reflectance spectroscopy of these emulsions sensitized with either sulfur or selenium that is not observed in the long-wavelength sensitivity measurements. This peak is assigned to a product of the chemical sensitization that is not photographically active. An energy level scheme was constructed based on the activation energies and photon absorption energies. This scheme indicated that all chalconide centers are poor hole traps, but their electron trap depth increases with increasing absorption wavelength. The speed advantage of selenium over sulfur sensitization is suggested to be due to fewer but slightly deeper traps created by the former sensitization.