

Abstract Submitted
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Coloration of single crystal ZnO with ultraviolet laser irradiation¹

ENAMUL KHAN, S.C. LANGFORD, J.T. DICKINSON, Washington State University — Many dielectric crystals color in the visible region of the spectrum when exposed to intense ultraviolet light such as excimer laser irradiation. In the alkali and alkaline earth halides, the decay of self-trapped excitons produces strongly absorbing defects. We were recently surprised to see single crystal ZnO darken dramatically during exposure to 193-nm ArF excimer laser radiation. ZnO is a wide bandgap (3.44 eV) semiconductor of significant technological interest. The increase in absorption is very broadband, extending from the bandgap into the infrared, and appears nearly black or grey. We present convincing evidence that this color is due to metallic zinc nanoparticles residing on the surface of the irradiated region. As expected, the laser fluence has considerable impact on the size, number, and spatial distribution of these nanoparticles. We propose a model for production of metallic nanoparticles on the surface.

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