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Zinc Vacancy Formation and its Effect on the Conductivity of ZnO[1] ENAMUL KHAN, MARC WEBER, STEVE LANGFORD, TOM DICKINSON, Washington State University — Exposing single crystal ZnO to 193-nm ArF excimer laser radiation can produce metallic zinc nanoparticles along the surface. The particle production mechanism appears to involve interstitial-vacancy pair formation in the near-surface bulk. Conductivity measurements made with one probe inside the laser spot and the other outside show evidence for rectifying behavior. Positron annihilation spectroscopy confirms the presence of Zn vacancies. We suggest that Zn vacancies are a possible source of p-type behavior in irradiated ZnO. Quadrupole mass spectroscopy shows that both oxygen and zinc are emitted during irradiation. Electron-hole pair production has previously been invoked to account for particle desorption from ZnO during UV illumination. Our results suggest that preexisting and laser-generated defects play a critical role in particle desorption and Zn vacancy formation.

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