Influence of annealing on Raman and photoluminescence spectra of single crystal ZnO

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Zinc oxide exhibits high electron mobility, wide 3.3eV band gap, ability to sustain large electric fields, relative low electronic noise, and strong luminescence at room temperature. These properties make ZnO invaluable for a broad range of applications. It is therefore important to study to influence of treatment on its properties under various conditions. In this work we compare Fourier transform infrared Raman (FTIR Raman, 1064 nm laser excitation, 70-3500/cm spectral range, 1/cm spectral resolution) and photoluminescence (PL, 360 nm UV LED excitation, 375-700 nm spectral range, 1 ns time resolution) optical spectra of as the received and annealed ZnO single crystals. The annealing has been done in oxidizing and reducing atmosphere at 350, 500 and 700C. The Raman spectra show two characteristic peaks at 100/cm and 440/cm associated with the sublattice oscillations of Zn and O, respective, and a broad PL band in the visible spectrum with mean time decay about 10 microseconds. The optical measurements are correlated with the topographical information obtained by atomic force microscopy (AFM). We analyze trends in the optical spectra related to vacancy rearrangements in the lattice, and showed a possible next course of action for further research.

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