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Structural and optical properties of ZnO films grown on ion-plated Ga doped ZnO buffer layers by atmospheric-pressure chemical vapor deposition using Zn and H_2O as source materials

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Zinc oxide (ZnO) films were grown on glass substrates with ion-plated Ga-doped ZnO (GZO) buffer layers at various substrate temperatures by atmospheric-pressure chemical vapor deposition using Zn powder and water as precursors. All the X-ray diffraction patterns of the ZnO/GZO films were dominated by a ZnO(002) peak, indicating the successful growth of highly *c*-axis oriented films. The substrate temperature dependence of growth rate was divided into three regions with the different activation energies, *i.e.* re-evaporation, mass-transport controlled and surface-controlled region. Scanning-electron-microscope observations revealed that the films grown at the substrate temperature in the mass-transport-controlled region exhibited the terrace-like surface morphology with the sharp rock-like structures. Photoluminescence spectra of the ZnO/GZO films were composed of a near-band-edge (NBE) emission at a wavelength of about 380 nm and a broad-band emission spreading over the visible