TW-P050

Self-Assembled ZnO Hexagonal Nano-Disks Grown by RF Sputtering

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Over the last decade, zinc oxide (ZnO) thin films have attracted considerable attention owing to large band gap of 3.37 eV and large exciton binding energy of 60 meV at room temperature [1-3]. Recent interest in ZnO related researches has been switched into the fabrication and characterization of low-dimensional nanostructures, such as nano-wires and nano-dots that can be applicable to manufacture the optoelectronic devices such as ultraviolet lasers, light-emitting-diodes and detectors. Since the optical properties of ZnO nano-structures might be distinct from those of bulk materials or thin films, the low-dimensional phenomena should be examined further. In order to utilize such advanced optoelectronic devices, one of the challenges is how to control the surface state related emissions that are drastically increased with increasing the density of the nano-structures and the surface-to-volume ratio. This paper reports the synthesis and characterization of self-assembled ZnO hexagonal nano-disks grown by radio-frequency magnetron sputtering. X-ray diffraction data and scanning electron microscopy data showed that ZnO hexagonal nano-disks were nucleated on top of the flat surfaces as the film thickness reached to 1.56 μm and then the number of nano-disks increased with increasing the film thickness. The lateral size of hexagonal nano-disks was ~720 nm and height was ~74 nm. The strong photo luminescence spectra obtained at 10 K was also observed, which was assigned to a surface exciton emission at 3.3628 eV arising from the surface sites of hexagonal nano-disks.

Keywords: ZnO, Hexagonal nano-disks, RF sputtering