

## Nanostructured surfaces

### Improvement of ZnO thin film crystal quality using different gas rate ratios by plasma enhanced chemical vapor deposition.

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Highly *c*-axis oriented Zinc oxide (ZnO) thin films were synthesized onto silicon (100) substrates by using plasma enhanced chemical vapor deposition (PECVD) [1-3] via different gas flow rate ratios ranged from 1:2.5 to 1:3.5. Carbon dioxide (CO<sub>2</sub>) and Diethylzinc (DEZn) [1] were used as precursors to supply oxygen and zinc sources, respectively. All the samples were synthesized under the same condition except the gas flow rate ratio. From the X-Ray Diffraction (XRD) results showed that the ZnO thin film synthesized at gas flow rate ratio of DEZn to CO<sub>2</sub> (1:3) with the strongest peak intensity and the narrowest full width at half maximum (FWHM) value [1, 2] as shown in Fig. 1, implying the best crystalline quality with (0002) texture. The surface morphology for the ZnO thin films synthesized onto silicon substrates was observed by using the scanning electron microscope (SEM) [4]. All the sizes for the ZnO grains have a basically uniform distribution approximately ranging from 80~120 nm as show in Figs 1(d), 1(e), and 1(f), respectively. The ultraviolet emission for the ZnO thin films synthesized onto silicon substrates located at about 370 nm by Photoluminescence (PL) was confirmed for all samples [2-5] as shown in Figs. 2(a), 2(b), 2(c), respectively. The FWHM values of the PL spectra were narrow almost, which are 26.42, 26.87 and 26.84 nm, respectively. The zinc and oxygen phase signals for the synthesized ZnO thin films were confirmed by energy dispersive spectrometer (EDS) spectra analysis [5] as shown in Figs 2(d), 2(e), and 2(f), respectively, indicating the zinc and oxygen peak signals were coexisted obtained from the ZnO compound phase films.

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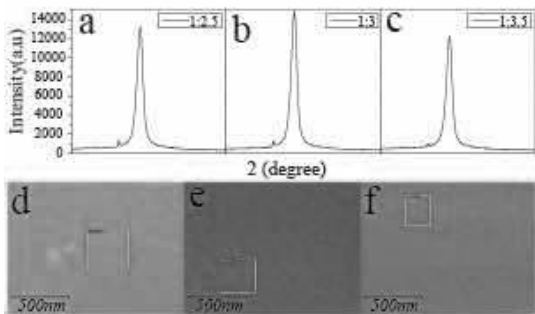


Figure 1. XRD patterns for the ZnO thin films synthesized onto silicon (100) substrates with the various gas flow rate ratios of (a) 1:2.5, (b) 1:1.3, and (c) 1:3.5, respectively. SEM surface morphology for the ZnO thin films synthesized onto silicon (100) substrates with the various gas flow rate ratios of (d) 1:2.5, (e) 1:1.3, and (f) 1:3.5, respectively.

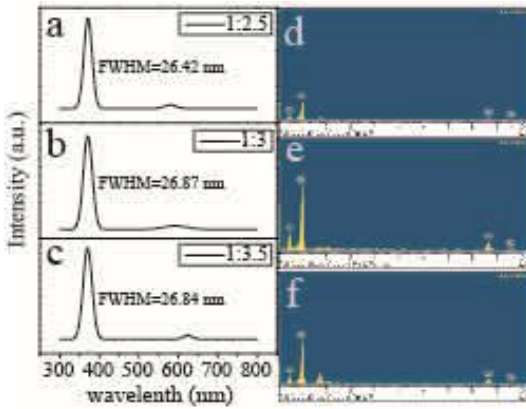


Figure 2. EDS analysis from SEM images marked in square area for the ZnO thin films synthesized onto silicon (100) substrates with the various gas flow rate ratios of (a) 1:2.5, (b) 1:1.3, and (c) 1:3.5, respectively. PL patterns for the ZnO thin films synthesized onto silicon (100) substrates with the various gas flow rate ratios of (d) 1:2.5, (e) 1:1.3, and (c) 1:3.5, respectively.