Photoluminescence of $(ZnO)_{0.92}(InN)_{0.08}$ films -Fabrication templature dependence-

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We have recently fabricated a new semiconducting material, $(ZnO)_x(InN)_{1-x}$ (called ZION hereafter), which is a pseudo-binary alloy of wurtzite ZnO and wurtzite InN [1-3]. The direct and tunable bandgap (1.7–3.3 eV) and the high optical absorption coefficient of 10^5 cm^{-1} make ZION a promising material for optoelectronic devices. Here, we report strong room-temperature (RT) photoluminescence (PL) from epitaxial ZION films, where the films grow in 2D mode on ZnO buffer layers fabricated on *c*-plane sapphire substrates. ZION films were deposited by RF magnetron sputtering on 18%-lattice mismatched *c*-plane sapphire substrates, where 0.7%-lattice-mismatched ZnO buffer layers were utilized [4]. O_2, N_2 and Ar gases were used and the total pressure was 0.3 Pa. ZnO and In targets were used. The substrate temperature was RT–450ºC. The film thickness was 100 nm. The chemical composition ratio of ZION films was $(ZnO)_{0.92}(InN)_{0.08}$. ZION films were excited by a cw He-Cd laser (325 nm, 6 mW) for PL measurements.

We have succeeded in 2D growth of ZION films on sapphire substrates with ZnO buffer layers by fabricating the films at RT–150ºC. The films show step-terrace structures with the step height of 0.27 nm, which corresponds to the height of a single-atomic-layer step and the half length of the *c*-axis lattice parameter of ZION. The ZION films have the same *a*-axis (in-plane) lattice parameter of 0.325 nm as ZnO, indicating the coherent growth of ZION films on ZnO templates. Furthermore, we observed strong PL emission from ZION films fabricated at RT–150ºC as shown in Fig. 1. Since such strong emission was not observed from 3D grown ZION films fabricated at 450ºC, we can conclude that high crystal quality associated with 2D growth is the key to obtain the strong PL emission from ZION films.

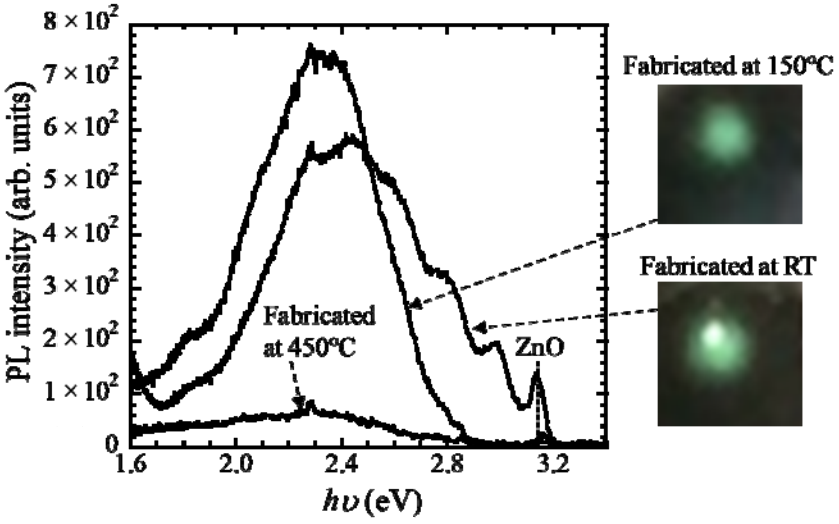

Figure 1. RT PL spectra of ZION silms as a parameter of deposition template.

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