



# **#PLATH00126** GROM / Thin films growth and modelling

# Epitaxial growth of $(ZnO)_X(InN)_{1-X}$ films by magnetron sputtering: effects of surface polarity of ZnO substrates

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### Abstract content

We have recently developed novel semiconductors,  $(ZnO)_x(InN)_{1-x}$  (called "ZION" hereinafter), which are pseudo-binary alloys of ZnO and InN. ZION have high exciton binding energy of 30–60 meV making ZION promising materials for various kinds of optoelectronic devices[1,2]. Here, we demonstrate epitaxial growth of ZION films on ZnO substrates by magnetron sputtering. Since substrate surface polarity often affects the film growth[3], we prepare ZION films on both Zn- and O-polar ZnO substrates and discuss the effects on the film quality.

ZION films were deposited on Zn- and O-polar ZnO substrates by radio-frequency magnetron sputtering.  $O_2$ ,  $N_2$  and Ar gases were used. The total pressure was 0.50 Pa. ZnO and In targets were used. The substrate temperature was  $450^{\circ}$ C.

High-resolution TEM images show that the heteroepitaxial growth of ZION films with atomically sharp interfaces on both Zn- and O-polar ZnO surfaces, however, a significant difference in the lattice relaxation process between the films is also observed. Figure 1 shows distance between Zn or In atoms as a function of ZION film thickness. On Zn-polar ZnO surfaces, relaxation occurs at the beginning of the film growth, whereas on O-polar surfaces, the ZION films are fully coherent with the 1.6%-lattice-mismatched ZnO substrates at least for 15 mono layers. The differences in the film quality are probably attributable to differences in the surface migration of Zn/In atoms between on Zn- and O-polar surfaces.

#### Thanks/Acknowledgement

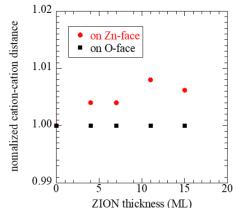
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## References

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#### Fig. 1. Cation-cation distance along the a-axis as

