Chemical-state-discriminated hard X-ray photoelectron diffraction study for polar InN

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InN has received great research attention because of the small bandgap (~ 0.7 eV) and superior electrical transport properties. As a wurtzite crystal lacks inversion symmetry along c-axis direction, In-polar and N-polar InN exhibit different properties. Therefore, investigation of near-surface structure and electronic states of polar InN films are important to fully realize their potential. Due to the element and chemical state specificity and the larger probing depth, hard X-ray photoelectron diffraction (HXPD) was used to investigate the near-surface structures of polar InN films [1].

The HXPD system consists of a monochromatic Cr Kα source (5414.7 eV), a high energy version of the VG SCIENTA R4000 10 kV analyzer with wide acceptance objective lens.The angle acceptance of the combined objective lens and the analyzer is ±35° with an angular resolution of 0.5°. The total energy resolution was 1 eV. In this study, the polar angle θ is defined to be zero for the photoemission direction normal to a sample surface. The θ-dependent sensitivity of the analyzer, was calibrated using an amorphous GeSbTe sample.

Figure 1 shows the HXPD patterns from In 3$d_{5/2}$ and N 1*s* core levels of In-polar and N-polar InN. The patterns were different from each other and then they were compared with the simulation results using a multiple-scattering cluster model[2], which is shown in Fig.1. It was found that the near-surface structure of the In-polar InN film was close to the ideal wurtzite structure. On the other hand, on the N-polar InN film, defects-rich surface was formed. In addition, the existence of the In-polar domains was observed in the HXPD patterns.

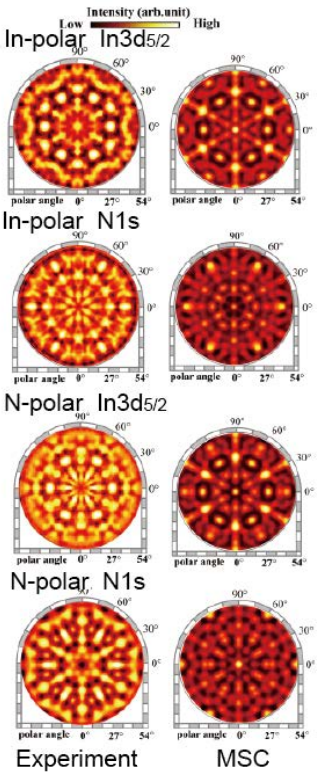

Fig.1:In3d and N1s HXPD for In-polar and N-polar InN

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References:
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