AlN template on Sapphire for Deep UV LED

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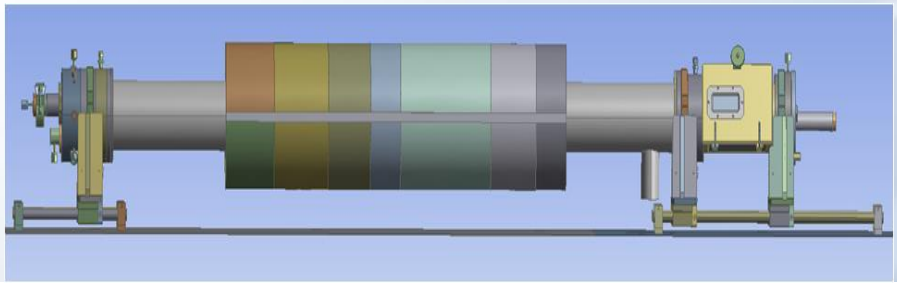
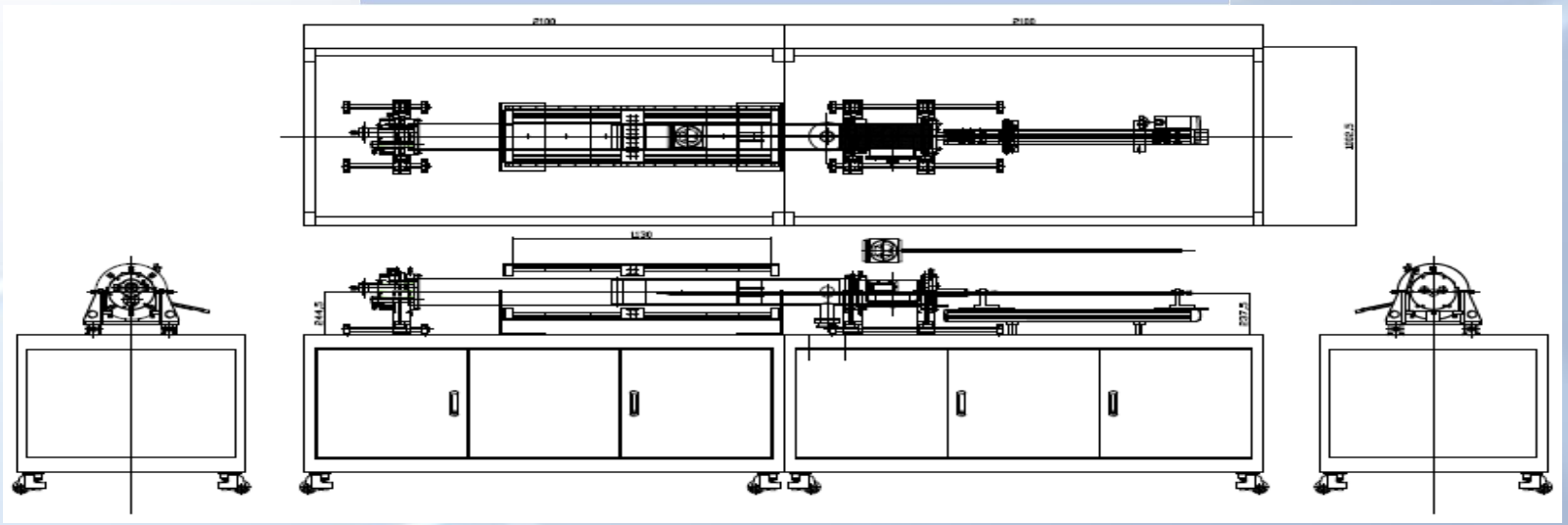
LumiGNtech Co., Ltd.

❖ Growth Method : HVPE

- Hydride Vapor Phase Epitaxy : 3 pcs x 2 inch wafer (Usually Sapphire)
- Maximum growth temperature : **1150℃**
- Crack free AlN layer thickness : typical ~ 2.0㎛ (maximum ~ 3.0 ㎛)

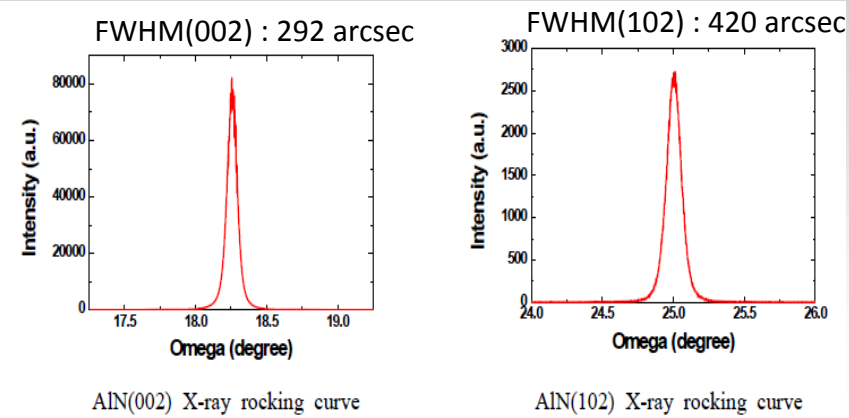




❖ Basic Properties : As grown AlN template

- FWHM of X-ray Rocking Curve , Optical tramsmission at Deep UV Range
- Surface morphology : Should be improved for Epi-Ready

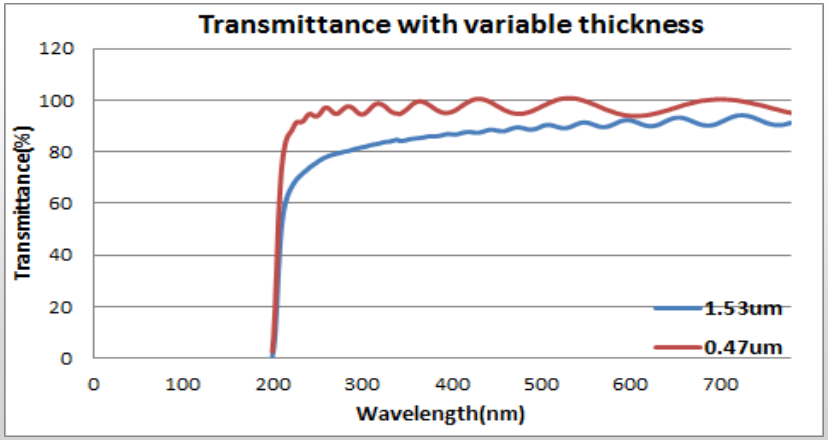
- FWHM of X-racy rocking curve



AlN(002) X-ray rocking curve

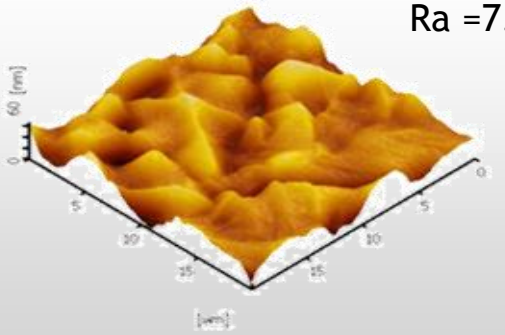
AlN(102) X-ray rocking curve

- Optical Transmission



- Surface morphology by OM(X200)

- Surface morphology by AFM (20x20㎛)



❖ Improvement of Surface morphology

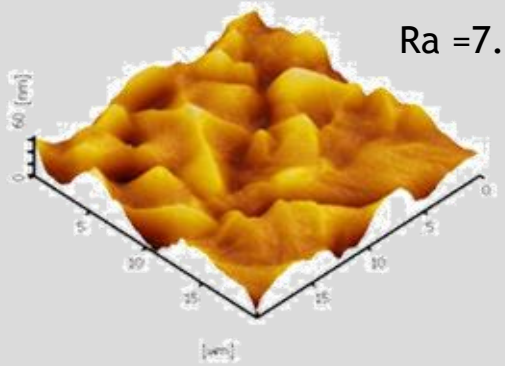
◆ Epi-Ready surface by introduction of Chemical Mechanical Polishing Process

As Grown surface

- Surface morphology by OM(X200)

- Surface morphology by AFM (20x20㎛)

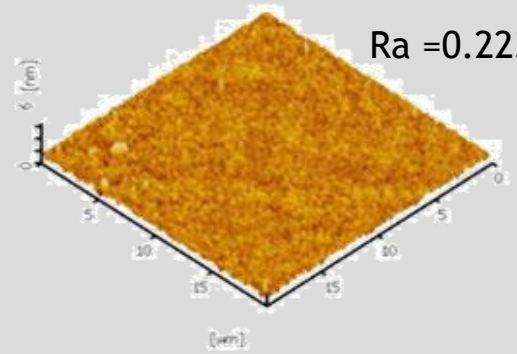
Ra =7.227nm



CMP Process

After CMP surface

Ra =0.223nm

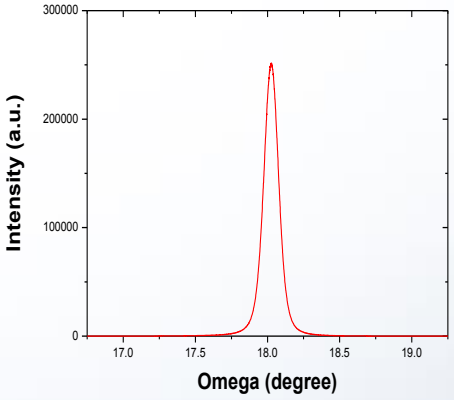


❖ AlN on Patterned Sapphire Substrate

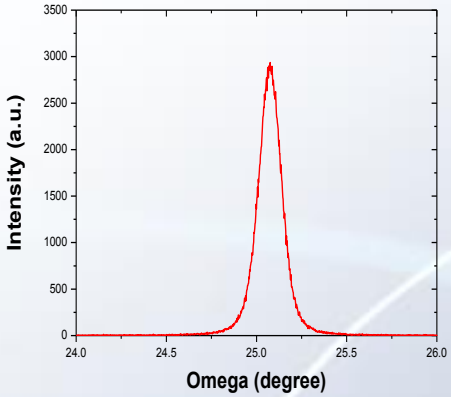
◆ AlN on Cylindrical PSS

- **FWHM of X-ray rocking curve**

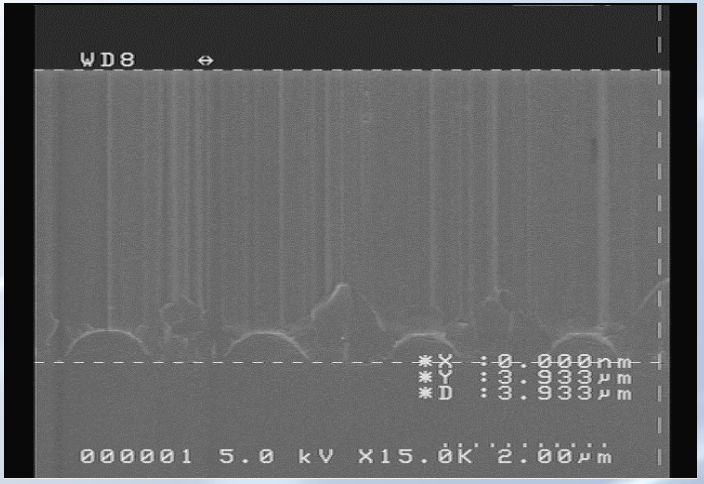
FWHM(002) : 428 arcsec



FWHM(102) : 530 arcsec

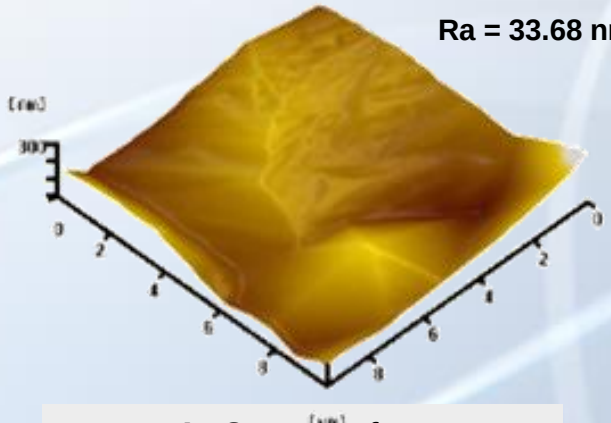


- **View of Cross-Section**



- **Surface morphology by AFM (20x20㎛)**

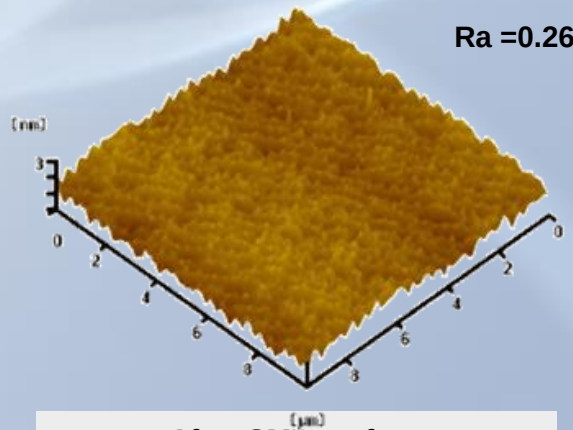
Ra = 33.68 nm



As Grown surface

CMP Process

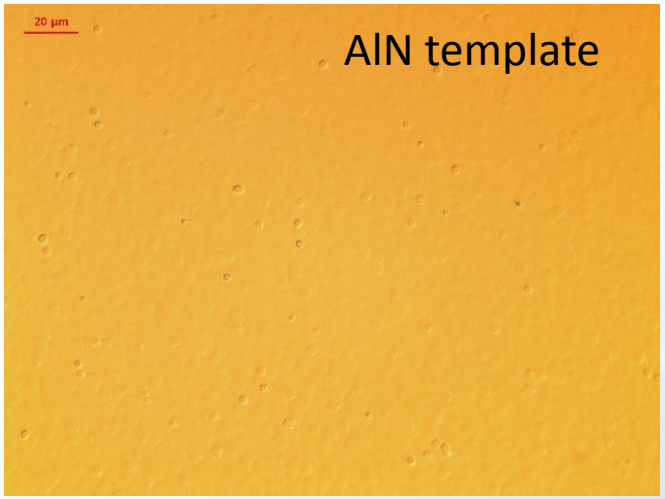
Ra =0.26nm

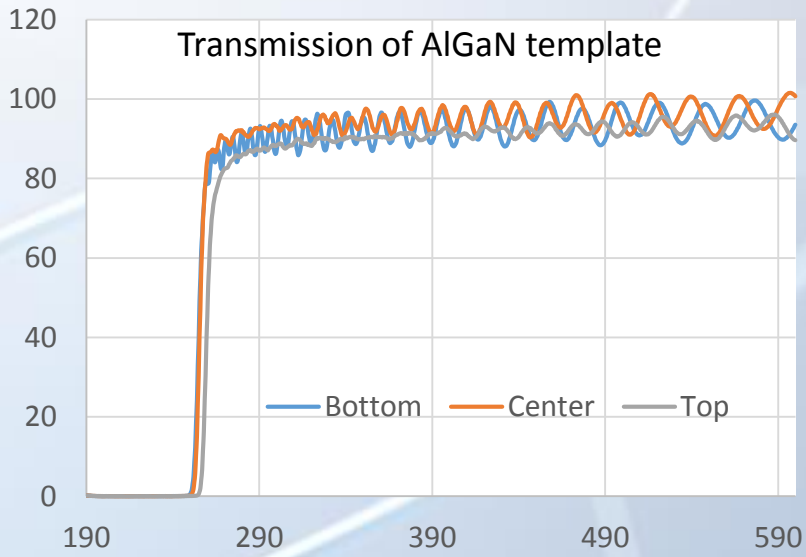


After CMP surface

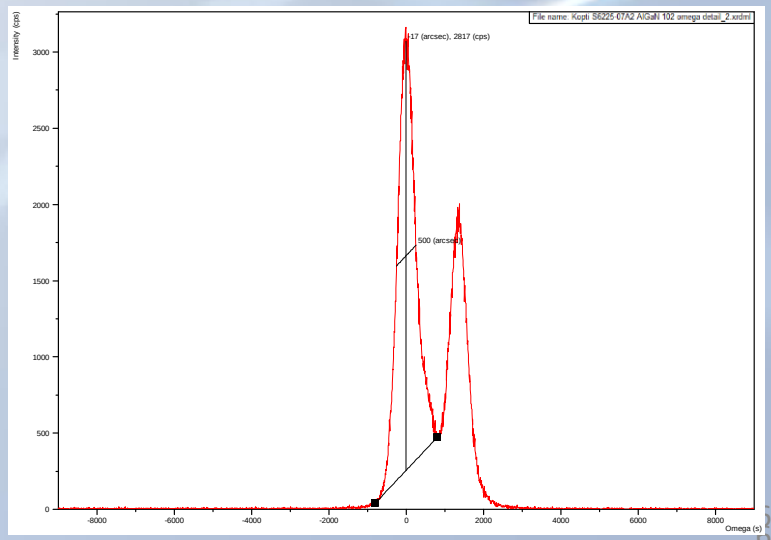
❖ AlGaN Regrowth on AlN template

◆ AlGaN(Al: 50%) on AlN template by conventional MOCVD (Veecon D300)



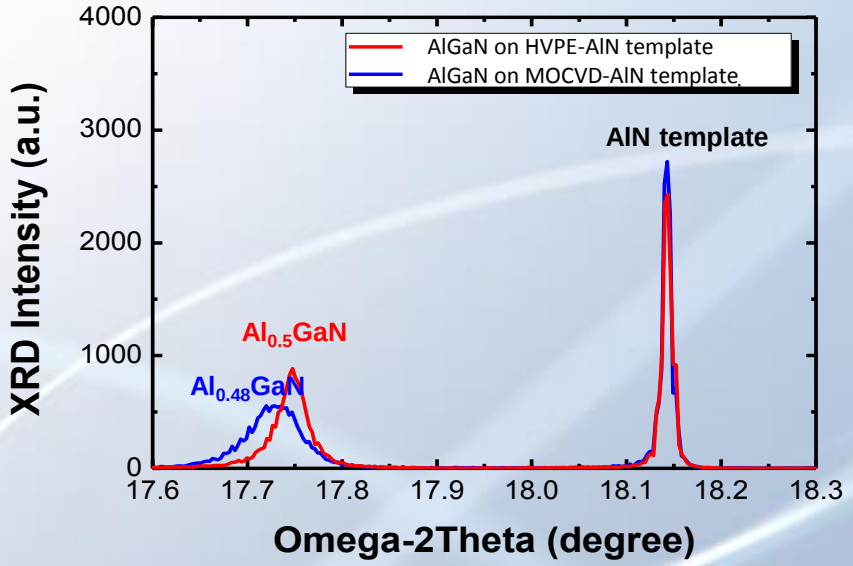


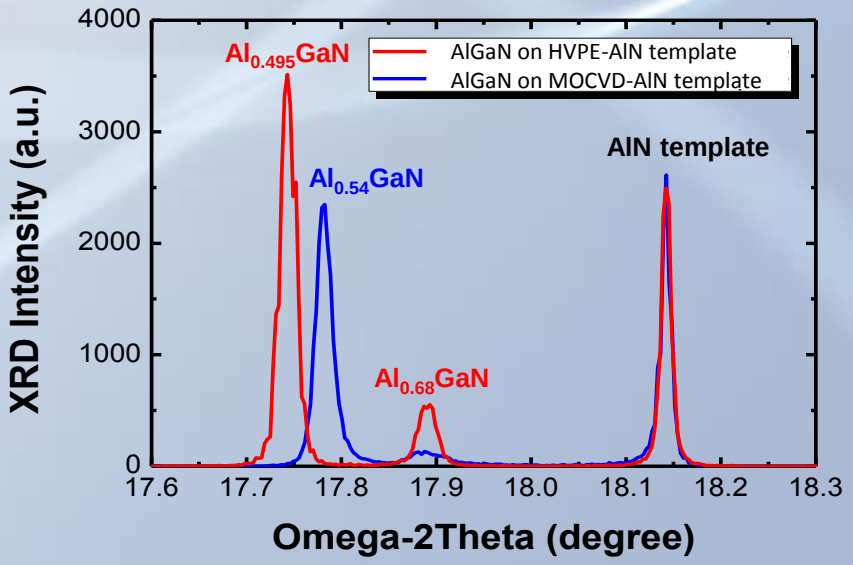
FWHM(102) of AlGaN layer : 500 arcsec



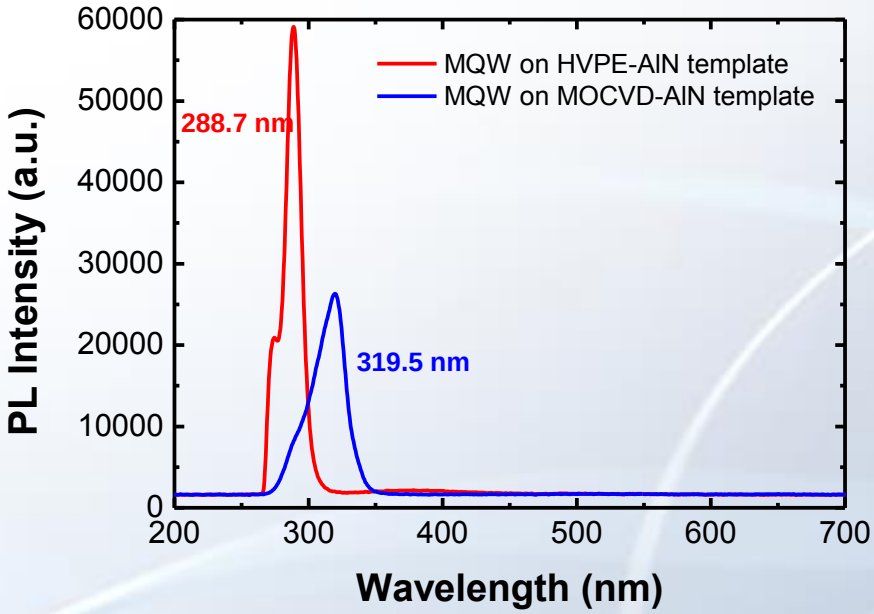
❖ AlGaN on AlN template (HVPE vs MOCVD)

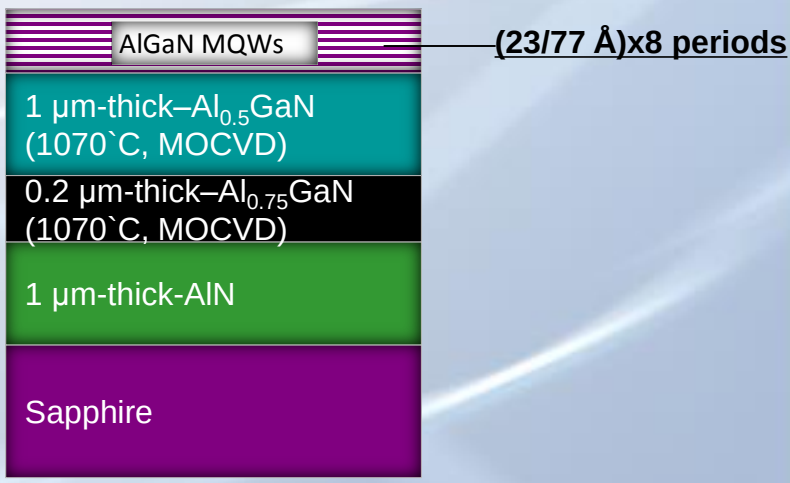
◆ XRD of AlGaN (Al: 50%) on AlN template (HVPE vs MOCVD)





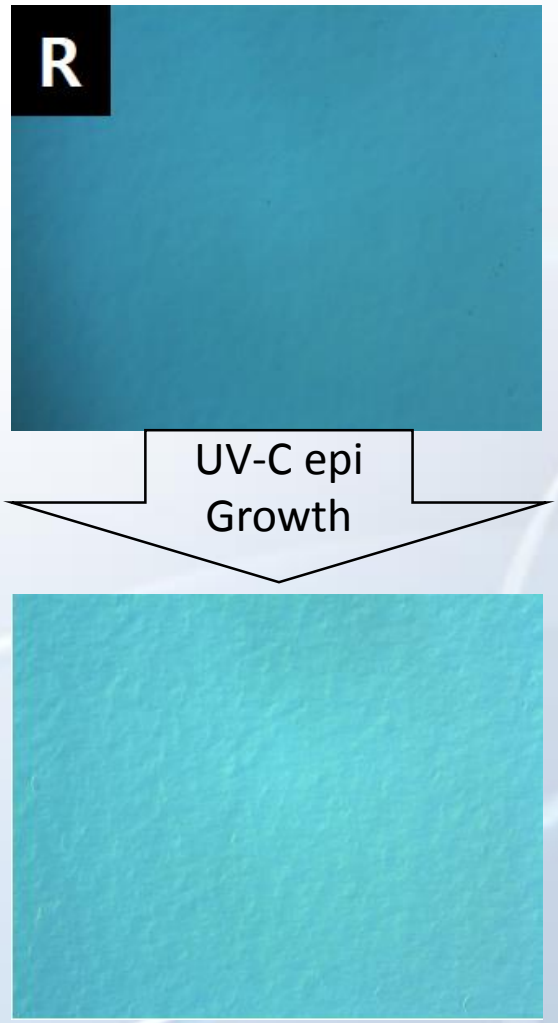
◆ MQW on AlN template (HVPE vs MOCVD) : Strain Effect ?





◆ UV LED EPI Regrowth on Lumi's AlN template

- Surface morphology by OM(X200)



- Vf of 275 nm UV LED epi-wafer