

Comparative study of GaN grown on on-axis and vicinal SiC (000 $\bar{1}$) substrates by hot-wall MOCVD

Hengfang Zhang, *¹ Ingemar Persson,³ Per Persson,³ Alyssa Mock,¹ Pitsiri Sukkaew,¹ Jr-Tai Chen^{1,2} and Vanya Darakchieva¹

¹Center for III-Nitride technology, C3NiT – Janzén, Linköping University, Linköping SE 581 83, Sweden

²SweGaN AB, Linköping SE 583 30, Sweden

³Thin Film Physics, IFM, Linköping University, Linköping SE 581 83, Sweden

*E-mail: hengfang.zhang@liu.se

Despite intense investigations on group-III nitrides, device-grade high-quality N-polar GaN epitaxial layers remain challenging. We study in a comparative manner epitaxial GaN layers grown on on-axis and 4° off-cut SiC (000 $\bar{1}$) substrates by hot-wall MOCVD. GaN epilayers are grown simultaneously on both substrates employing with N-polar AlN nucleation layers (AlN-NLs). We investigate difference surface morphologies and crystal qualities of GaN epilayers on the two substrates. Growth mechanisms leading to different polarities on the two types of substrates are discussed based on transition electron microscopy (TEM) findings. Different growth rate of GaN epilayers caused by mix-polarity is determined on on-axis SiC (000 $\bar{1}$) substrate. Crystallographic structures, strains and defects of GaN and AlN epilayers are characterized by TEM. The nature of AlN-NLs and its interfaces with the substrates and GaN epilayer is discussed. Atomic arrangement at the interface and possible bonding configurations are also analysed.