Crystal structure characterization of Ga_2O_3 epitaxial layer using TEM

Gallium Oxide(Ga_2O_3)is an attractive wide-band-gap semiconductor material for a next-generation power semiconductor device. Quality of the epitaxial growth film is very important to realize high-performance power device. By transmission electron microscope(TEM), the crystal structure of Ga_2O_3 epitaxial layer on sapphire substrates can be characterized.

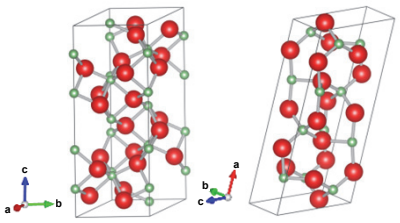
About Ga_2O_3

- Five polymorphs
  α-, β-, γ-, δ-, ε-, κ-Ga_2O_3
- Wide bandgap（～5eV）
- Low cost and high quality substrates.

High voltage and low loss power devices

Crysrtal structure of Ga_2O_3

α-Ga_2O_3 β-Ga_2O_3



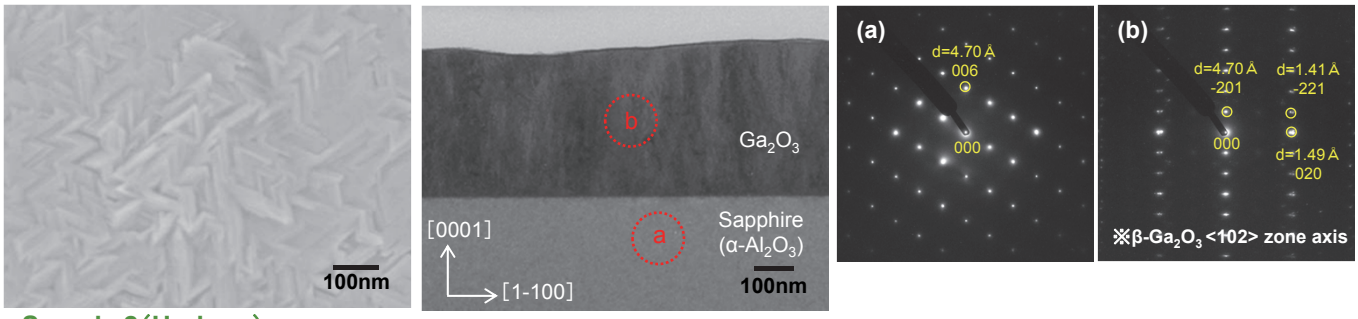
α-Ga_2O_3	β-Ga_2O_3
metastable phase	stable phase
corundum-structured	monoclinic
bandgap 5.3eV	bandgap 4.9eV

Morphological and crystal structure analysis using SEM and TEM

Sn-doped(Sample 1) and undoped(Sample 2) Ga_2O_3 are characterized using SEM and TEM.

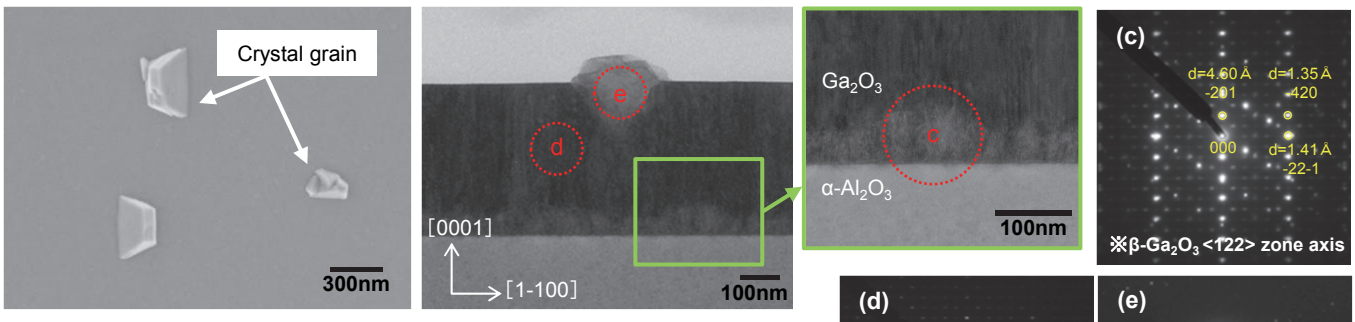
Sample 1（Sn dope）

【Plane SEM image】 【Cross-sectional TEM image】 【Diffraction pattern】



Sample 2（Undope）

【Plane SEM image】 【Cross-sectional TEM image】 【Diffraction pattern】



- Surface morphology of Sample1 is different from that of Sample2.
- (-201)-oriented β-Ga_2O_3 were grown on sapphire substrates. (diffraction pattern of (b), (c))
- In Sample2, area (d) is κ-Ga_2O_3 (orthorhombic). (diffraction pattern of (d))
- The growth direction of the crystal grain (e) is different from epitaxial layer. (diffraction pattern of (e))

TEM showed orientations of Ga_2O_3 film and microstructural details of the interfaces.