

APPLICATION NOTE

# Reverse Engineering of Compound Semiconductor Optoelectronics

## DISCUSSION

When information is required from a finished and packaged device, EAG Laboratories can depackage and deprocess the sample and then fully characterize it using various analytical techniques. Information that can be obtained includes:

- sample structure
- surface passivation layer presence (and thickness)
- active region thickness
- composition of the various layers
- dopant type (P or N), concentration and depth distribution
- composition (mole fraction) in ternary layers such as AlGaN or InGaN etc
- contaminant type, level and depth distribution

Other specific questions can also be addressed. The exact analysis carried out and the equipment used will depend on the priorities of obtaining different types of information (thickness, composition, dopant level etc). The most commonly used techniques are SIMS, SEM and TEM.



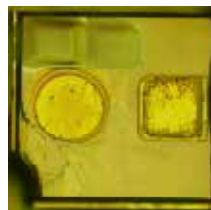
Commercially available LED



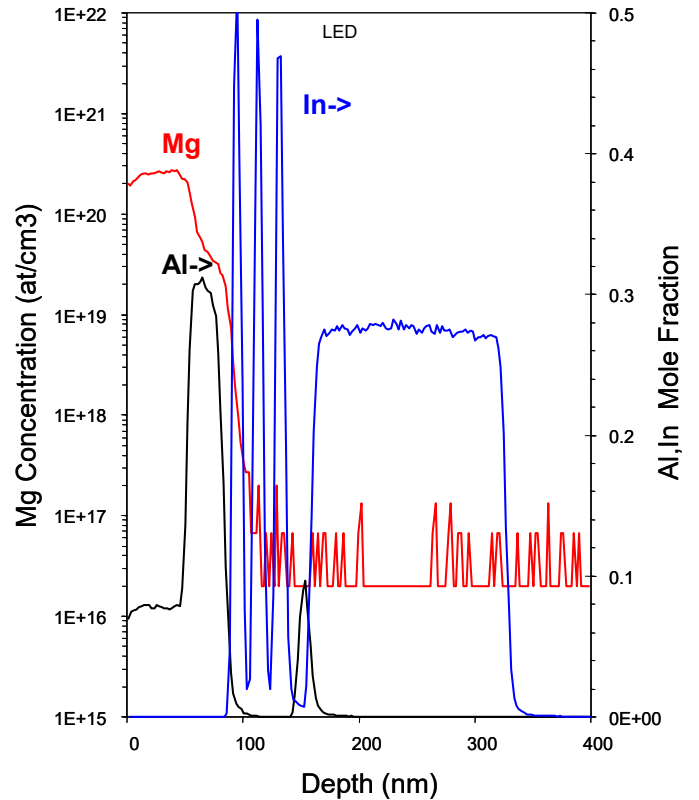
Sample surface after polishing



Sample surface after depackaging  
Die size:  
300 x 300mm



Sample surface after SIMS analysis  
SIMS crater:  
100 x 100mm



This example shows a SIMS depth profile of a blue LED device. SIMS showed the structure to be of the type: AlGaN/[InGaN/GaN]×3/AlGaN/InGaN/GaN, as seen from the Al and In profiles. The dopant (Mg and Si) distribution and concentration were also successfully measured.