

LED Technology

Course Introduction

The LED technology course gives a comprehensive introduction to the technology of LEDs, starting with the basic semiconductor fundamentals followed by special attention to LED semiconducting materials. The LED chip processing with epitaxy process and chip architecture is introduced with focus on light outcoupling and current spreading for efficiency improvement. Finally, application sensitive features of LEDs are discussed.

Course Objective

Students will be able to:

- 1) Describe the main peculiarities for creation of an LED, the main semiconductor materials and properties, LED characteristics and reasons for the brightness increase compared to classic light bulbs.
- 2) Describe the main fabrication processes; material specialties and features for light extraction increasement.

Course Methodology

Topics shall be presented by the tutor using MS Powerpoint slides and/or written on a white board to guide the students.

Other relevant information (eg literature, lecture notes, simulation files, etc) will be given during the class

Target Audience

Students or engineers working in industry who have a Bachelor's degree in engineering or natural sciences (physics and/or chemistry) and who are interested to deepen their knowledge in LED Technology.

Pre-requisites

Ideally basic knowledge of semiconductor physics

Course Duration

5 days, 9am - 5pm

(we can customize the duration per your requirement)

Availability

TBD



To enquire further, please contact
lkyong@northern-technische.com

About Us

Northern Technische Consulting is a company dedicated to support growing needs of talents, critical skills and competence development for high capital-intensive and high value-added technology-related industries primarily in the fields of Semiconductors, Optoelectronics, Solar Photovoltaics, and Advanced Materials, Advanced Electronics and Biomedical Engineering in Kulim Hi-Tech Park and beyond

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LED Technology Course Contents

- 1. Introduction / Motivation**
LED Market, OSRAM OS
- 2. Semiconductor Basics – Electrically**
Bandstructure, effective mass, density of states, Fermi function, carrier density, pn-junction, Shockley equation
- 3. Semiconductor Basics – Optically**
Direct/indirect semiconductor, radiative electron-hole recombination, nonradiative processes, rate equation
- 4. Material systems for opto-semiconductors**
Band structure of InGaN - also piezo fields, AlGaAs material system, InGaAlP
- 5. Epitaxy**
Methods-Metal organic vapour phase epitaxy, growth modes, composition, applications, material system specialities, characterization methods, quantum films, doping, impurities
- 6. Chip Process – FOL and EOL**
Basic process technologies, laser lift off, thinning, laser dicing, etc
- 7. Back-End – LED Packages**
Assembly & Test
- 8. Efficiencies**
Internal quantum efficiency, external efficiency, wall plug efficiency
- 9. Carrier transport / Current spreading**
Carrier distribution in pn-junctions, ohmic contacts, carrier loss, electron blocking layers
- 10. Light Extraction**
Total internal reflection, surface modification, thin film LED, new trends
- 11. Degradation**
Principle of degradation measurements, physical origins – models, lifetime estimation models
- 12. Application of LEDs**
SSL, automotive, traffic, displays, background illumination
- 13. Photometry**
Sensitivity of the eye, chromaticity diagrams, photometric parameters, white LEDs

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