The University Of Sheffield.

Electronic & Electrical Engineering.

EEE6395 COMPOUND SEMICONDUCTOR DEVICE MANUFACTURE

Credits: 30

Course Description including Aims

The unit will cover the theory and practice of the growth of compound semiconductor epitaxial layers, the characterisation of those layers and the design, fabrication and characterization of compound semiconductor devices such as LEDs, laser diodes, photodetectors, solar cells and transistors. Students will gain practical experience in all aspects of the creation of a compound semiconductor electronic device including the safety issues associated with device manufacture. Students will also obtain a broad understanding of the global importance of compound semiconductor technology manufacturing through study and exposure to of a number of leading edge research programmes.
By the end of this module, students will be able to:

1 Demonstrate an understanding of, and the ability to apply, a range of industry standard and leading edge technologies available for compound semiconductor design, manufacture, and characterization;
2 Identify safety hazards in the growth of compound semiconductors and in the fabrication processes that create devices.
3 Demonstrate practical skills in the processes involved in the fabrication of a simple component and in making opto-electronic device measurements
4 Demonstrate an appreciation for the importance of the subject in industrial/commercial environments

Outline Syllabus

Review of basic compound semiconductor theory.

Epitaxial growth techniques (MOVPE, MBE), theory and current issues/trends in epitaxial growth.

Characterisation techniques for epitaxial materials (e.g. C-V, PL mapping, X-ray diffraction).

Device fabrication steps (e.g. lithographic techniques including photolithography and nanolithography and metrology, wet etching, ICP/RIE dry etching, plasma deposition, metallization, cleaving, bonding)

R&D status of Optoelectronic devices such as lasers, photodetectors, solar cells, Electronic devices (e.g. GaN HFETs), Biophotonic applications, Solid state lighting

Microscopy of compound semiconductors (e.g. SEM, TEM)

Practical application of epitaxial growth techniques and materials characterization.

Practical application of device fabrication steps to process devices from materials grown on the course.

Practical application of device characterization techniques to devices fabricated on the course.

Time Allocation
75 contact hours (lectures, lab, seminars and tutorials)

Recommended Previous Courses

This course is only available to students registered for the MSc in Semiconductor Photonics and Electronics

Assessment
Essay (25%), Process document (25%), Lab report (in style of an IEEE letter) on fabrication and characterization of opto-electronic device (40%), attendance (10%).

Recommended Books

Epitaxy, M. Hermann, Springer
Introduction to Microfabrication, S. Franssila, Wiley
Fundamentals of microfabrication, M. Madou, Boca Raton
Process Technology for Semiconductor Lasers, K. Iga, Springer
More text is advised during the course

Objectives
1 Demonstrate an understanding of, and the ability to apply, a range of industry standard and leading edge technologies available for compound semiconductor design, manufacture, and characterization;
2 Identify safety hazards in the growth of compound semiconductors and in the fabrication processes that create devices.
3 Demonstrate practical skills in the processes involved in the fabrication of a simple component and in making opto-electronic device measurements