OR1101

Synthesis of zinc oxide films without thermal assistance: achieving high conductivity, epitaxy and exciton confinment

David Horwat[1], Martin Mickan[2], William Chamorro[2]

[1]Insitut Jean Lamour, Nancy, France [2]Institut Jean Lamour, Nancy, France

david.horwat@univ-lorraine.fr

Zinc oxide is a multifunctional semiconductor owing to its large bandgap, dopability and large exciton binding energy.It can be doped with many different ions (Al, Ga, Zr, B, V, …) and can show very low resistivity of the order of $10^{-4}\Omega$ cm while keeping a large transparency in the visible range. These properties make doped ZnO a strong candidate to replace Indium Tin Oxide (ITO). Moreover, the recombination of electron-hall pairs in ZnO induces light emission at an energy located just at the boundary between the UV and visible ranges. For UV-based applications (UV diodes, photodiodes and lasers), it is required to shift this emission deeper in the UV. This is usually achieved by the fabrication of quantum dots but other methods are highly sought. In general, ZnO thin films of high optical and electrical quality are required for a variety of applications. This is directly linked to their microstructure that must be optimized. Also, new applications arise in which it is necessary to prevent the thermal degradation of materials associated to zinc oxide and deposition on flexible substrates is targeted. Therefore, the synthesis without thermal assistance of zinc oxide films with controlled conductivity and optical emission is necessary.

This presentation reviews some of the achievements on the synthesis and characterization of zinc oxide thin films we have made at Institut Jean Lamour. In particular, we detail the possibility to lower the resistivity, manipulate the near band edge emission and achieve epitaxy using reactive magnetron sputtering without thermal assistance.

Keywords
ZnO
reactive magnetron sputtering
high conductivity
epitaxy
luminescence