Numerical and experimental study of the effects of the carrier gas in MOCVD growth

Javier Yeste[1]*, Vicente Muñoz-Sanjosé[1], Carmen Martínez-Tomás[1], Saïd Agouram[1]
*Javier.Yeste@uv.es
[1] Departament de Física Aplicada i Electromagnetisme, Universitat de Valencia, Spain

The carrier gas plays a key role during growth by MOCVD since it dramatically determines the hydrodynamic and thermodynamic conditions in the reactor, which affect the physical and structural properties of the grown crystal. However, the effects of the carrier gas in the growth can be difficult to characterize in a closed system like an MOCVD reactor.

In order to understand the implications of using a specific carrier gas, a two-step study has been developed. For this, we combine the results of numerical simulations performed with the software COMSOL Multiphysics with sets of growths whose results can be correlated with the main features shown by the simulations.

In this presentation, we will show the implications of the carrier gas election regarding the hydrodynamic conditions, temperature gradient and precursor mixing. The simulations, which have been programmed to describe our equipment, a horizontal two-inlet MOCVD reactor (*Quantax 226*), have been carried out for both light gases, such as H_2 and He and heavier gases, like N_2 and Ar. Moreover, these simulations will be correlated with a series of growths of CdO and the ternary alloy CdZnO with different morphologies (thin films and nanoparticles) on r-sapphire and GaAs substrates, performed with N_2 and He. We will show that key features of the crystal properties like morphology or composition are greatly affected by the carrier gas choice.