Strain relaxation mechanisms

David Holec
Department of Materials Science and Metallurgy, University of Cambridge
Pembroke Street, Cambridge, CB2 3QZ, United Kingdom

Generation of misfit strain during growth of a thin epilayer is a well known phenomenon. Misfit strain arises from the difference of the substrate and epilayer lattice parameters. For very thin layers it is energetically favourable to accommodate the misfit strain elastically whereas for thicker epilayers different defects are introduced in order to accommodate the misfit strain.

In this talk some experimental observations of misfit dislocations (MDs), which are created in the substrate-epilayer interface, are presented. MDs are quite well described for the cubic SiGe/Si systems for which several theories have been developed. As we are interested in the hexagonal InGaN/GaN systems, a straightforward application of formulas derived for isotropic case of SiGe/Si is at least debatable. The difference between the hexagonal and isotropic formulas is demonstrated on the critical thickness vs. indium content curve with variation as big as h_c=8.8nm for hexagonal and h_c=14.1nm for isotropic case for indium content x=0.20.

Experimental observations of strain relaxation mechanisms in InGaN/GaN layers such as the misfit dislocations and V-pits are also presented.

Future work will focus on developing a theoretical model describing the misfit strain relaxation for MDs and V-pits in InGaN/GaN layers. The current methodology for a single layer grown on a substrate will be extended for the case of multiple quantum wells structures which are of particular interest in LED technologies.