Centre de Nanosciences et de Nanotechnologies

Soutenance de thèse

Mardi 29 janvier

14h 00

Amphithéâtre IPVF

Daniel PELATI

" Elaboration of GaAs solar cells based on textured substrates on glass"

Jury members :

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Abstract :

The increasing demand for clean energy has driven research toward higher efficiency and lower cost solar cells. Gallium Arsenide solar cells detain the record efficiency for single junction but the high cost of the substrate limits their applications. In this thesis, we investigate an alternative GaAs substrate based on a low-cost silica support coated by a thin (20nm) Germanium layer. The latter is near lattice-matched to GaAs and the layer can be crystallized with a high (111) texture using Metal Induced Crystallization (MIC). However this requires a carefully optimization of the deposition and annealing parameters. Here, we use a specially designed *in situ* optical microscope to optimize the annealing sequence. In particular, we identified two crystallization pathways, of which one should be minimized to obtain a good (111) crystalline texture. We then perform the heteroepitaxy of GaAs on this Ge seed layer using Molecular Beam Epitaxy, keeping the initial (111) crystal texture. We identify specific growth conditions for the twin- and defect-free growth of GaAs on Ge(111) surfaces. We also observe the growth of GaAs (111)A polarity on Ge (111) rather than the expected (111)B orientation. Finally, we fabricate (111) oriented GaAs solar cells with 15,9% efficiency on monocrystalline GaAs(111)B substrate. The transfer to standard Ge(111) monocrystalline wafers and to our Ge-coated silica pseudo-substrates reveals doping issues related to the (111)A orientation of the GaAs, as well surface roughening due to grain boundaries in the initial Ge seed layer.

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