CIGS growth on a GaP/Si(001) platform : towards CIGS/Si tandem solar cells.

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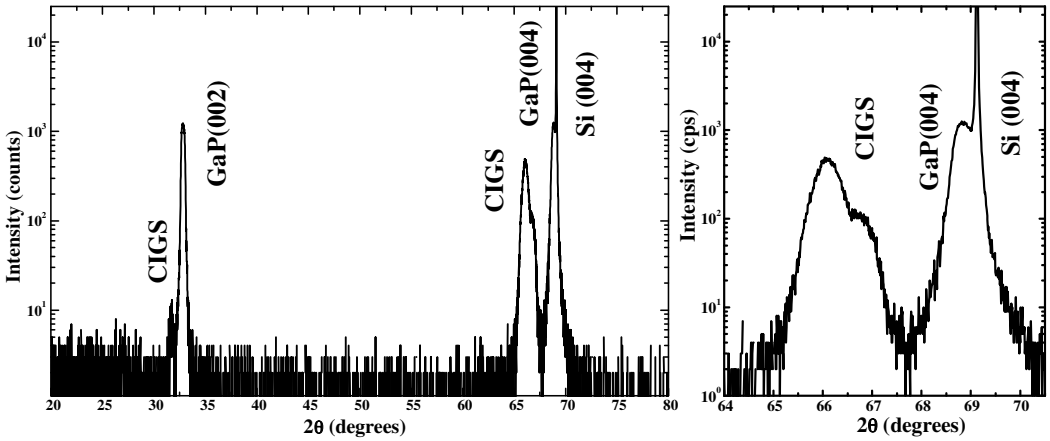
To date, the best conversion efficiencies have been obtained with multijunction solar cells on III-V substrates. However, maintaining the GaAs or germanium substrates to build these high-efficiency III–V solar cells is costly. We propose to explore tandem junctions associating single crystalline silicon bottom cell, with a bandgap of 1.12 eV and CIGS top cell, specially optimized for working in the blue/UV range (bandgap around 1.7 eV), with a new and disruptive approach based on using wide bandgap GaP intermediate layers. Our purpose is to grow wide band gap CIGS films under quasi-epitaxial conditions on GaP to improve the CIGS top cell efficiency, thanks to a reduction of the structural defects density detrimental for the cell performance. A first challenge is the formation of a low recombination contact with the GaP layer, taking advantage of the better structural and electronic matching than with the commonly-used Glass/Mo substrates, so that quasi-epitaxial CIGS-Si tandem solar cells can emerge as cost competitive for the next generation of PV modules.

Epitaxial GaP quasi-lattice matched have been grown on Si(001) substrate by MBE, to realize III-V/Si dislocation-free pseudosubstrates.[1, 2] First results on the CIGS growth on a GaP/Si(001) pseudo-substrate are reported. In particular, x-ray diffraction evidences a strong crystalline texture of the CIGS, which illustrate the influence of the GaP(001) surface on the CIGS structural quality.



Left :θ/2θ x-ray diffraction scan on a CIGS/GaP/Si(001) sample. Right : Zoom around the Si(004) Bragg diffraction peak.

[1] P. Y. Wang, A. Letoublon, N. T. Thanh, M. Bahri, L. Largeau, G. Patriarche, C. Cornet, N. Bertru, L. A. Corre, O. Durand, *Journal of Applied Crystallography* **2015**, *48*, 702–710.

[2] P. Y. Wang, J. Stodolna, M. Bahri, J. Kuyyalil, N. T. Thanh, S. Almosni, R. Bernard, R. Tremblay, D. M. Silva, A. Létoublon, T. Rohel, K. Tavernier, L. Largeau, G. Patriarche, L. A. Corre, A. Ponchet, C. Magen, C. Cornet, O. Durand, *Appl Phys Lett* **2015**, *107*, 191603