Wide bandgap Cu(In,Ga)S_2 thin film solar cell : a promising partner for c-Si based tandem devices

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The photovoltaic market is dominated by the c-Si technology, which represents about 95 % of the production capacity over the world. Solar cells based on c-Si have reached efficiency above 26 %, which corresponds to 85% of efficiency theoretical limit. To further increase the performance of the panels, one option is to better exploit the solar spectrum through a so called tandem structure. This latter consists in adding a semi-transparent solar cell on top of the c-Si device. The best matching top cell bandgap should be between 1.6 eV and 1.8 eV.

Sulfur based chalcopyrite $CuIn_{1-x}Ga_xS_2$ (CIGS) semiconductor has a direct bandgap varying from 1.5 eV up to 2.4 eV when x increases from 0 through 1. Solar cells based on this material thus appear as well adapted for being used as top cell. However, the fabrication of high efficiency CIGS cells for tandem application implies several specific structural changes that are still the seeds for both technological and fundamental developments. The present contribution aims at giving an overview of these bottlenecks and detail the solutions proposed by the scientific community to overcome them.