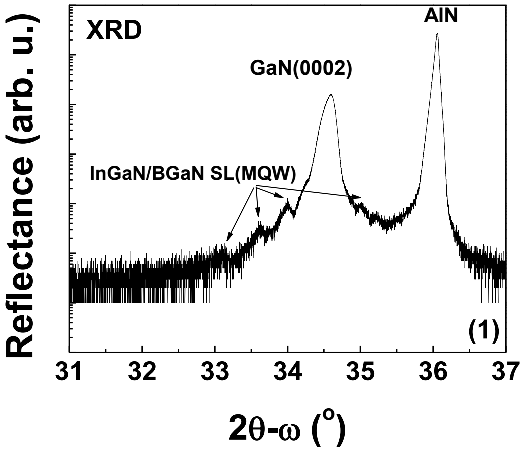
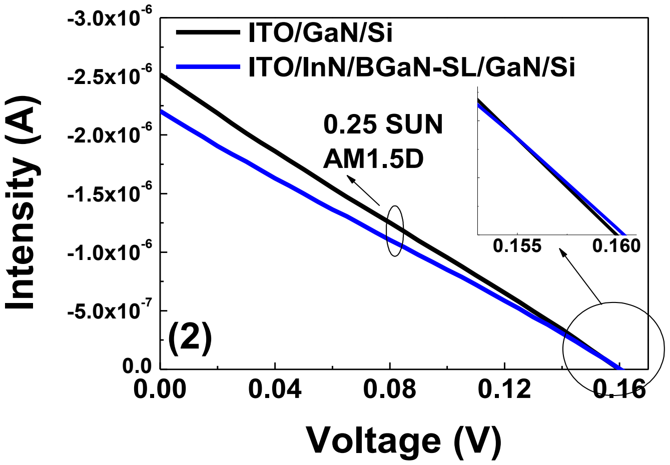
The revision of InN bandgap to a much narrower value of 0.7 eV has extended the fundamental bandgap of the group III-nitride alloy system $In_xGa_{1-x}N$ over almost the entire spectral region (3.4 eV for GaN). This allows the fabrication of tandem (multijunctions) solar cells (they own the actual record conversion efficiency) using a single material system, reducing thus the costs considerably. However, despite challenging results, the use of InGaN-on-GaN as a veritable photovoltaic material is still at early stages mainly due to the severe deterioration of material quality with high-In incorporation (phase segregation and highly compressive strain) necessary to achive the desired low bandgap cell in multijunction tandem cells..

Our approach comes to aleviate this annoying botleneck in development of InGaN/GaN solar cell technology by proposing an innovative InGaN/BGaN superlattice, based on the remarcable lattice constant reduction and bandgap shrinking by the incorporation of B. Thus, using an advanced growth technique, molecular beam epitaxy (MBE), InGaN/BGaN superlattice heterostructures (multiquantum well -MQW) have been realized, as seen in Fig. (1). Introducing such low dimesional heterostructures in a solar cell led to only a small enhancement in open-circuit voltage (V_{oc}) but, on other hand, to an undesired decrease in short circuit current (I_{sc}). This indicates that, despite strain compensation the presence of boron led unavoidably to deterioration of the host semiconductor matrix (3) even starting from small boron contents > 1-2 %.





Using irradiation with 6 MeV electrons to fluences around 10^{16} electrons/cm^2 followed by rapid thermal treatment at high temperatures has proved a way to enhance the optical properties of BGaN compound, as seen in Fig. (4).