

## Crystal Defects in Epitaxial Structures and their Impact on Physical Properties of Photoconverters

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Heterostructures are one of the most important components of numerous micro- and optoelectronic devices, including high-efficiency tandem solar cells. The most effective multicasade photoconverters with the efficiencies more than 25% are based on epitaxial heterostructures, grown by MOCVD or MBE technology. The highest efficiency solar cells have been achieved by the introduction of pseudomorphic epitaxial layers to cover the main part of solar spectrum. Introduction of such components allows extended absorption range, but drastically drops crystal perfection, significantly degrading the potential advantages of such improvements.

Tandem solar cells theoretically achieve higher efficiency by extending the fraction of the utilized solar spectrum through the supplement of the additional band gaps. However, a critical trade-off exists between the number of materials in the solar cell and the ability to achieve low defects densities. Tandem solar cells achieved efficiencies over 40%, using lattice matched heterostructures. However, the band gaps of the lattice matched solar cells are non – ideal, giving rise to significant efforts to develop metamorphic layers structures. Despite the more optimum bandgaps, the degradation of crystal perfection makes the efficiencies of the metamorphic devices essentially the same as the lattice-match configuration.

Our report shows results of our investigations on creation of crystal defects in epitaxial structures. The suggested model of this process is based on statistic nature of atoms deposition and inevitable creation of point defects on the growth front of epitaxial structures. Diffusion, accumulation and structural transformation of point defects into extended ones depend on growth conditions, i.e. initial elastic strain, deposition temperature, deposition rate and thickness of deposited layer. Finally growth conditions significantly affect types, density and spatial distribution of crystal defects in the volume of epitaxial structures. We will consider correlations between growth conditions and defect's types in epitaxial structures. In spite of the inevitability of creation of crystal defects during epitaxial growth, this process is predictable and hence we can actively affect it by optimizing growth conditions and device construction.