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A lattice-matched material platform for multijunction solar cell applications

Yong-Hang Zhang*

Center for Nanophotonics & Dept. of Electrical Engineering,

Arizona State University, Tempe, AZ 85287, USA.

* Email: yhzhang@asu.edu.

The monolithic integration of lattice-matched II-VI (MgZnCd)(SeTe) and III-V (AlGaIn)(AsSb) semiconductors on 6.1 Å substrates such as GaSb and InAs provides a novel material platform for ultra-high efficiency multijunction (MJ) solar cells [1-3] . These materials have direct bandgaps covering the entire solar spectrum from 0.4 to 3.0 eV. The lattice-matching condition enables the epitaxial growth of innovative solar cell structures with a large number of junctions while maintaining an extremely low defect density. These semiconductor materials have very similar thermal expansion coefficients, leading to better stability and reliability of tandem-cell structures. The band offsets between some of the II-VI and III-V materials are type-II, which is ideal for tunnel junctions with small series resistances. This invited alk will report the recent progress in theoretical modeling, MBE growth, doping, and characterization of the proposed materials and device designs.

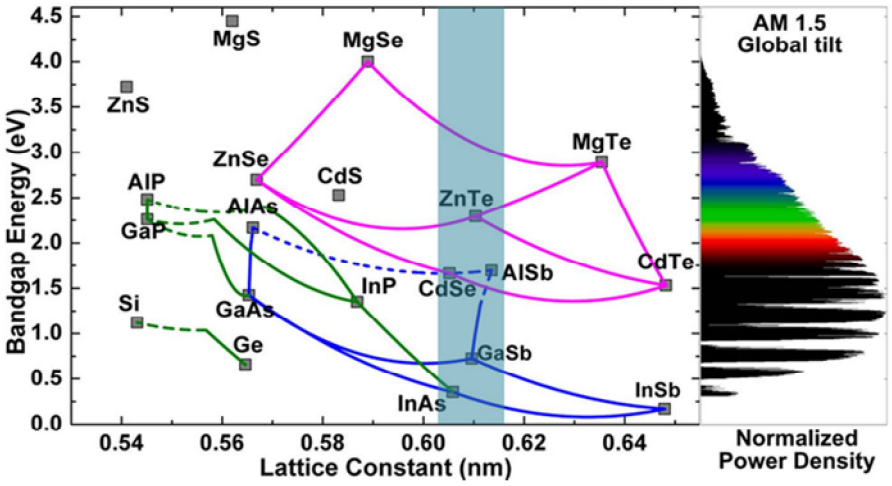

Fig. 1. Bandgaps versus lattice constants for various II/VI and III/V bianries and their alloys.

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