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Band structure studies of buried materials using picosecond photoacoustic waves[1] YING XU, ANDREW STEIGERWALD, JINGBO QI, NORMAN TOLK, Vanderbilt University — Time-resolved, wavelength dependent, pump probe studies using photo-generated picosecond coherent acoustic phonon (CAP) waves could provide layer-by-layer information about the electronic structure of materials over a wide depth range. At the anomaly in the electronic structures, such as the semiconductor band gap, a strong variation in the measured probe signal is observed Semiconducting heterostructures interfaces and defect distributions have been investigated and successfully characterized using the CAP technique. Two parameters are investigated in details here, the phase and the amplitude. We observe a distinctive phase discontinuity at the interfaces separating the heterostructures layers. For a radiation-damaged lattice, we show that continuously varying amplitude changes in the phonon oscillations corresponds to the variation in the electronic structure. This work confirms that CAP is a novel and effective tool to study the detailed band edge structures of materials and to characterize buried layers, with nanometer resolution.

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