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Thesis Defense of Lipin CHEN on next 15 june.
You can communicate this information to colleagues, who may be interested.

Thesis Defense
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Tuesday 15th june 2021, 9:30 am (amphi Bonin)

Optoelectronic, vibrational and transport properties of III-V/Si antiphase boundaries for photonics and solar energy harvesting

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Abstract

This thesis aims to investigate the specific optoelectronic properties of III-V/Si Anti-Phase Boundaries (APBs) and its use for energy harvesting devices theoretically and experimentally. Strong electron-phonon coupling around stoichiometric APBs are first demonstrated due to simultaneous confinement of charge carriers and phonons in the same region, based on structural and optical characterizations and density functional theory calculations. The GaPSb/Si tandem materials association for solar water splitting is then studied. Combining ellipsometry measurements and tight binding calculations, the bandgap of GaPSb alloys in the whole Sb range and band lineups of GaPSb/Si with water redox levels are obtained, which shows the potential of the GaPSb/Si association for the hydrogen evolution and oxygen evolution reactions. Then a GaP0.67Sb0.33/Si photoanode with an almost optimal bandgap combination (1.7eV/1.1eV) was investigated for photoelectrochemical (PEC) water splitting with promising performances related to efficient sunlight spectrum absorption. Finally, the transport and PEC properties of III-V/Si with vertical non-stoichiometric APBs are investigated from experimental characterizations and first-principle calculations. We demonstrate that epitaxial III-V/Si materials with vertical non-stoichiometric APBs are hybrid structures, composed of bulk photo-active semiconductors with 2D topological semi metallic vertical inclusions, enabling simultaneously good photo-activity, efficient charge transport and separation, and interesting ambipolar properties.

***KEYWORDS** : III-V/Si semiconductors ; antiphase boundaries ; 2D materials ; vertical homovalent singularities ; optoelectronic properties*