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InAs/InSb axially heterostructured nanowires for small junction area semiconductor diodes ALESSANDRO PITANTI, DANIELE ERCOLANI, LUCIA SORBA, STEFANO RODDARO, FABIO BELTRAM, NEST Scuola Normale Superiore & CNR NANO p.zza S. Silvestro 12 56127 Pisa Italy, LUCIA NASI, GIANCARLO SALVIATI, IMEM CNR parco Area delle Scienze 37/A 43010 Parma Italy, ALESSANDRO TREDICUCCI, NEST Scuola Normale Superiore & CNR NANO p.zza S. Silvestro 12 56127 Pisa Italy — Semiconductor nanowires are low-dimensional systems which appear as ideal candidates to enable ultra-fast electronic technology. Even if the realization of complex [1], nanowire-based electronic devices such as transistors and diodes has been demonstrated, the ultra-small axial electronic capacitance, related to the semiconductor tiny cross-section, is rarely exploited, due to the difficulty in creating homo/hetero-junctions within the nanowire itself. We propose a solution to produce axial, majority-carrier diodes, by employing growth interruption to create InAs/InSb heterojunction along the nanowire axis [2]. Despite being both InAs and InSb n-type materials, their broken gap band alignment produces strong asymmetry in the I-V characteristic, similarly to standard Schottky-barrier diodes. The band line-up determines a strong nonlinear current response at positive source-drain bias: when an additional InP barrier layer is inserted in-between the heterojunction, the maximum nonlinearity is drawn towards zero bias and the leakage current reduced, making these devices promising candidates for high cut-off frequency rectifying detectors/photomixers.

[1] N. Wang et al., Mat. Sci. Eng. R 60, 1 (2008).
[2] A. Pitanti et al. Phys. Rev. X 1, 011006 (2011).

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