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High performance InAs-based type-II superlattice infrared photo-detectors

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I will report our recent works on InAs-based superlattice photodiodes. The InAs/GaSb superlattice materials were conventionally grown on GaSb substrates and have achieved excellent successes. However since the lattice constant of InAs is smaller than that of GaSb, GaSb-based superlattice structures are highly strained. The longer the cutoff wavelength, the bigger the strain is. This issue can be eliminated if the superlattice structures are grown on InAs substrates. Moreover, the growth temperature of the superlattice materials on InAs substrates can be significantly increased, which helps to improve the superlattice's electrical properties, such as minority carrier lifetime, which is a bottleneck for superlattice photo-detector's performances. InAs/GaSb superlattices on InAs substrates with sharp X-ray diffraction peaks have been obtained for the first time, indicating high crystalline quality of the material. Superlattice structures with different InAs thickness in each period was grown and examined. The results show that the lattice mismatch of the superlattices to the InAs substrates is not sensitive to the InAs thickness. Cutoff wavelength can be tuned from 6 μm to 12 μm by varying the InAs layer thickness from 14 MLs to 26 MLs. Optical responses and quantum efficiency are measured and changes linearly with the absorption thickness. P-I-N detectors based on the InAs-based superlattice materials have also shown excellent electrical performances, which will be presented and discussed in detail in the talk.

Biography

Jianxin Chen has completed his PhD from the Graduate School, Chinese Academy of Sciences. He has been with Shanghai Institute of Metallurgy, Chinese Academy of Sciences; Swiss Federal Institute of Technology at Laussane; Bell Laboratories, Lucent Technologies; and Princeton University. He is now a Professor of Shanghai Institute of Technical Physics, Chinese Academy of Sciences. He has authored and co-authored more than 80 peer-reviewed journal papers. His current research interests are quantum structured materials for optoelectronic devices.

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