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ZnO-based Quantum Structures for Terahertz Sources

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In this paper we report on the numerical study of the terahertz devices based on metal oxide semiconductors and its application in biology and medicine. We also report on the recent progress of the theoretical and experimental studies of ZnO-based THz quantum cascade lasers (QCLs) and resonant tunneling diodes (RTDs). We show that ZnO-based semiconductor compounds are promising materials for fabrication terahertz sources operating up to room temperature due to their unique properties such as large bandgap and conduction band offset (CBO) energy, high LO-phonon energy, and high resistant to the high breakdown electric field. Moreover, it was established that the ZnO-based terahertz sources can cover the spectral region of 5-12 THz, which is very important for THz imaging and detection of explosive materials, and which could be not covered by conventional GaAs-based terahertz devices. In terms of the reported significant progress in growth of non-polar m-plane ZnO-based heterostructures and devices with low density defects, it is open a wide perspective towards design and fabrication of non-polar m-plane ZnO-based high power terahertz sources with capabilities of operation at room temperature.