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Title:Room-temperature resonant-tunneling-diode terahertz oscillator based on precisely controlled semiconductor epitaxial growth technology

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Abstract:This article presents the recent achievement of fundamental oscillations in resonant tunneling diodes (RTDs) above 1 THz at room temperature. One of the key technologies for this achievement is precisely controlled epitaxial growth of ultrathin semiconductor heterostructures. The structural design of oscillators and microfabrication technology are also crucial. To increase the oscillation frequency toward the terahertz range, we devised a novel RTD structure with a graded emitter, which effectively reduces both the operating bias voltage and electron transit time in the collector depletion region. An InP-based InGaAs/AlAs RTD oscillator with a graded emitter and 1.2-nm-thick barriers exhibited fundamental oscillations with frequencies of up to 1.04 THz at room temperature, which is the highest oscillation frequency ever reported in single solid-state electron devices. This project is part of collaborative research and development between NTT and Tokyo Institute of Technology.

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