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Title:Investigation of coherent acoustic phonons in terahertz quantum cascade laser structures using femtosecond pump-probe spectroscopy
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Abstract:The dynamics of acoustic vibrations in terahertz quantum cascade laser structures (THz-QCLs) is studied by means of femtosecond pump-probe spectroscopy. The phonon modes are characterized by the folding of the acoustic dispersion into an effective reduced Brillouin zone. An accurate identification of this dispersion allows the sample structure and periodicity to be determined with high precision on the order of 0.1%. By temperature tuning the energy of the electronic levels of the system and performing wavelength dependent measurements, we are able to study the impulsive resonant generation and detection of coherent acoustic phonon modes. These results are supported by simulations of the electronic system that well explain the experimental observations. The effects of interface (IF) roughness on coherent acoustic phonon spectra are clearly observed for equal nominal THz-QCL structures but with different interface qualities. © 2012 American Institute of Physics.
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