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Title:Temporal response and reflective behaviors in all-optical switch based on InAs/GaAs one-dimensional quantum-dot resonant photonic crystal

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Abstract:The temporal responses and the reflected digital signal behaviors of a novel InAs/GaAs one-dimensional quantum dot resonant photonic crystal (QD-RPC) with 400 periods of unit cell, consisting of an InAs quantum dot (QD) layer and other GaAs barrier layer, are theoretically investigated by using a transfer matrix method. We demonstrate that the stopband (resonant photonic band gap) has fast response and the Nyquist rate is up to 1.15 THz centered at Bragg reflection wavelength 1242.3 nm. The square-wave time series with the duration of 10 ps reflected by the stopband is transmitted and the intensity of pump light utilized is only 0.32 MW/cm<sup>2</sup> when this structure acts as an all-optical switch for a given temperature 45 K and relative size fluctuation 0.1%. In addition, the extinction ratios of this optical switch associated with temperatures and signal pulse durations are analyzed and discussed. © 2012 Elsevier B.V.

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