Switchable tunneling mode for cylindrical photonic quantum well consisting of photonic crystals containing liquid crystal

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Abstract

We proposeacylindricalphotonicquantumwellmadeofphotoniccrystalscontainingliquidcrystals, the propertiesofwhicharetheoreticallycalculatedandinvestigatedbythetransfermatrixmethodin the cylindricalsymmetrysystem.Liquidcrystalsareintroducedintothephotonicquantumwell structureastunabledefectlayers.Whentheliquidcrystalsarepseudo-isotropicstateandthe azimuthalmodeorderofincidentwavesare m¼0, thereweretwopass-bandsaroundcertain wavelength.Whentheliquidcrystalsarehomeotropicstate,thereflectanceofpass-bandatshorter wavelengthdecreasesfrom0.75to0.05intheTMmode,butthereflectancedoesnotchangeintheTE mode.Whenmodeorder m¼1 andtheliquidcrystalsarepseudo-isotropicstate,thereflectanceof defect modestayedthesameas m¼0. However,theresultisreversedwhilethephaseofliquidcrystals changefrompseudo-isotropictohomeotropicstate.Thereflectanceisthesameasin theTMmode,but that intheTEmodedecreasessubstantiallyfrom0.75to0.05.Theapplicationofourstructureto switchingdeviceishighlypotential.

Keyword：photonic crystal