# The theoretical study of coherent tunneling effect in ZnO/$Mg_{0.18}Zn_{0.82}O$ double barrier structure

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The so-called resonant tunneling structure is an important model for the discussion of electron transmission in semiconductor nanostructure. Moreover, double barrier resonant tunneling device (DBRTD) shows high potential in application of ultrahigh frequency mixing and microwave millimeter wave oscillation circuits, analog-digitals converters, multi-valued logic circuits and others. ZnO is a wide gap semiconductor, which have characteristics of much higher exciton bound energy, more resistant to radiation damage and the comparable electron steady-state drift velocity in higher applied field strength than other semiconductor at room temperature. Recent advances in ZnO and ternary $Mg_xZn_{1-x}O$ epitaxial growth have demonstrated high quality epitaxial layers suitable for a ZnO/ $Mg_xZn_{1-x}O$ barrier/well hetero-structure suitable for resonant tunneling device. In the paper, the energy band diagram for ZnO/ $Mg_{0.18}Zn_{0.82}O$ double barriers structure was determined according to the experimental and theoretical results. In order to research the quantum mechanical resonant tunneling effect through the DBRTD, the DBRTD structure was regard as two single-barrier tunneling structures which were separated by a quantum well. The quantized values of electron bound-state energy in the quantum well were calculated. The transmission coefficient for different well width and barrier thickness for a symmetric ZnO/ $Mg_{0.18}Zn_{0.82}O$ double barrier is discussed. The current-voltage characteristics for DBRTD were also studied. This investigation is to provide a dependable evidence for design, fabrication, testing and applications of a ZnO/ $Mg_xZn_{1-x}O$ DBRTD.

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