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Exciton States inZnO/MgZnO Quantum Wells under Electric Field and Magnetic Field

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Zinc oxide (ZnO) and related alloys are regarded as competitive materials for blue and ultraviolet optoelectronic devices, widely used in commercial and military areas for the next-generation applications. In this work, we take into account the effect of geometric structures, material components, axial electric field, and transverse magnetic field on the exciton states of ZnO/MgZnO quantum wells by the variational method within the framework of effective-mass envelope-function theory. Calculations indicate that the exciton binding energy is a non-monotonic function of the well width. And the exciton binding energy is non-linear as the Mg component increases. The exciton binding energy decreases with the increase of electric field but increases with the increase of magnetic field. The combined effects of axial electric field and transverse magnetic field on the binding energy indicate that they can compensate each other. In addition, the uncorrelated probability is investigated in the quantum well under the electric and magnetic fields.

Keywords: exciton, quantum well, variational method, electric field, magnetic field.