Abstract Submitted
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Electroabsorption of wide bandgap semiconductors GaN and ZnO: the theory and experiments XIYAO ZHANG, Department of Physics, North Carolina State University, ANDREW OBERHOFER, JOHN MUTH, Department of Electrical and Computer Engineering, North Carolina State University, SEMICONDUCTOR PHOTONICS RESEARCH TEAM — Dow and Redfield developed a theoretical model in 1970's to describe the change of the broadening of exciton absorption peak and the tilting of band edge in semiconductor under an electrical field. In this work, we apply this generic model to different kinds of wide bandgap semiconductors, such as GaN and ZnO. The exciton electroabsorption problem can be treated non-perturbatively in the center-of-mass coordinate as one electron in a Coulomb potential and an electrical field. The corresponding three-dimensional Schrdinger equation was solved for the electron-hole envelope wavefunction at the origin and the density of states per unit energy by introducing parabolic coordinates. Elliot formula was then used to calculate the actual optical electroabsorption coefficient. Thermal broadening of the exciton absorption peak was considered by convoluting a Guassian function, whose line width is related to the temperature. Experimental temperature dependent absorption data of GaN and ZnO were measured from 77K to 300K. The electroabsorption spectra of GaN in an optical modulator structure have also been examined. These experiment results were used to verify the theoretical model of electroabsorption of wide bandgap semiconductors.

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