Then, the induced electric polarization screens the built-in internal electric field and reduces the compressive strain, which reduces the tilting of the band structure of InGaN/GaN MQWs. Therefore, the PL peak blueshifts and the frequency of the InGaN $A_1(LO)$ phonon redshifts. When the applied magnetic field exceeds the saturation field, the magnetization remains constant and in turn the magnetostrictive effect saturates. As a result, the deformation and the optical properties of InGaN/GaN MQWs follow the same trend.

4. Conclusion

In summary, we have demonstrated the ME effect in new composites consisting of InGaN/GaN multiple quantum wells and magnetostrictive ferromagnetic thin films. The ME effect is very pronounced and can be detected optically at room temperature. In addition, the ME effect can be manipulated by the optical transition within multiple quantum wells and becomes optically tunable. Based upon both advantages of optical detection and tunability, the composites shown here pocesses a unique feature of multi-functionality, which can combine the novel ME effects and outstanding optical and piezoelectric characteristics of nitride semiconductors. The new composite shown here represents an excellent illustration for the generation of artifitial material system with magnetic/electric/optical inter-related/controllable properties. In addition, it provides a new route to integrate ME effects with mature light emitting technology, which holds a wider and an immediate scientific impact and is able to produce distinct devices for practical applications in the near future.

Acknowledgments

This work was supported by the National Science Council and the Ministry of Education of Taiwan.