



Study of the strain relaxation in InGaN/GaN multiple quantum well structures

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Outline

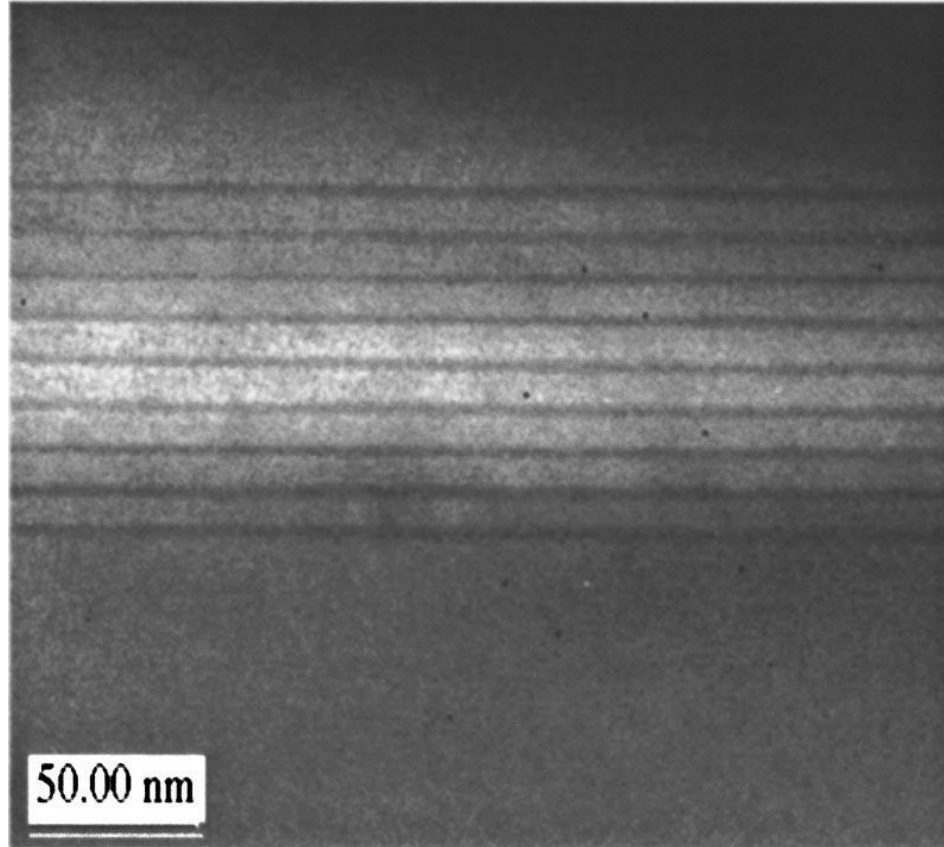
- Introduction
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Introduction

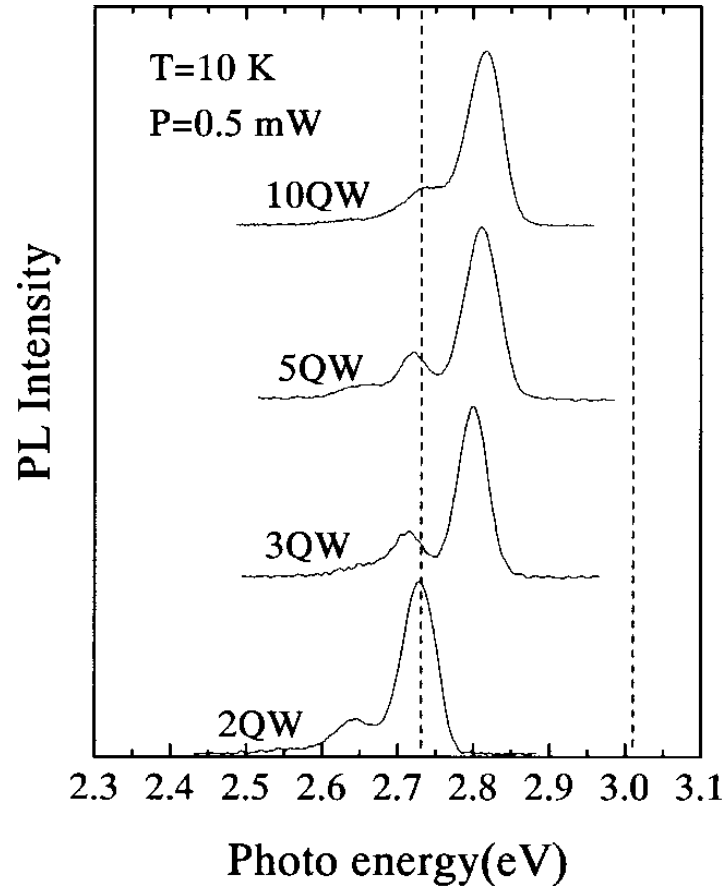
- The relationship between strain relaxation and quantum well number in InGaN/GaN multiple quantum well (MQW) structures.
- Investigated by x-ray diffraction (XRD) And low-temperature photoluminescence (PL) measurements.

Result and Discussion



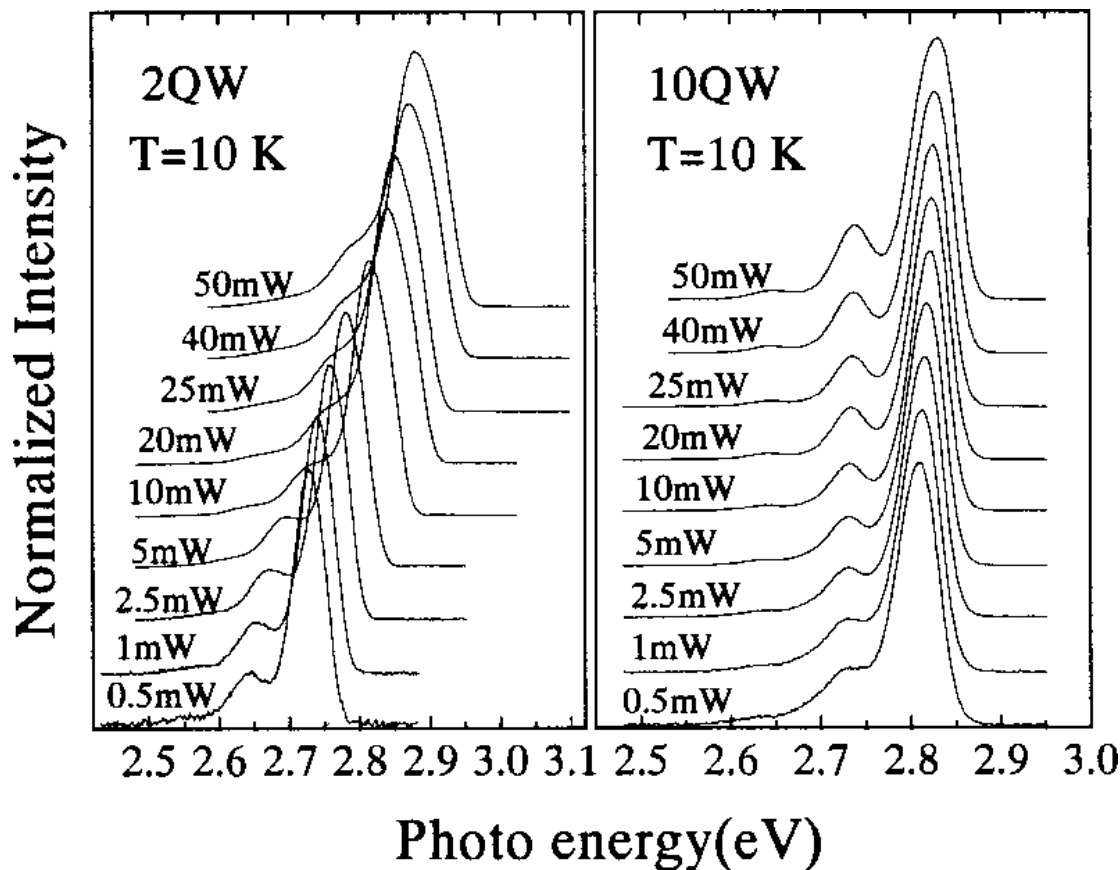
- FIG. 1. Cross-sectional TEM images of the samples with 10 periods, taken near the (1120) zone axis with $g=[0002]$

Result and Discussion



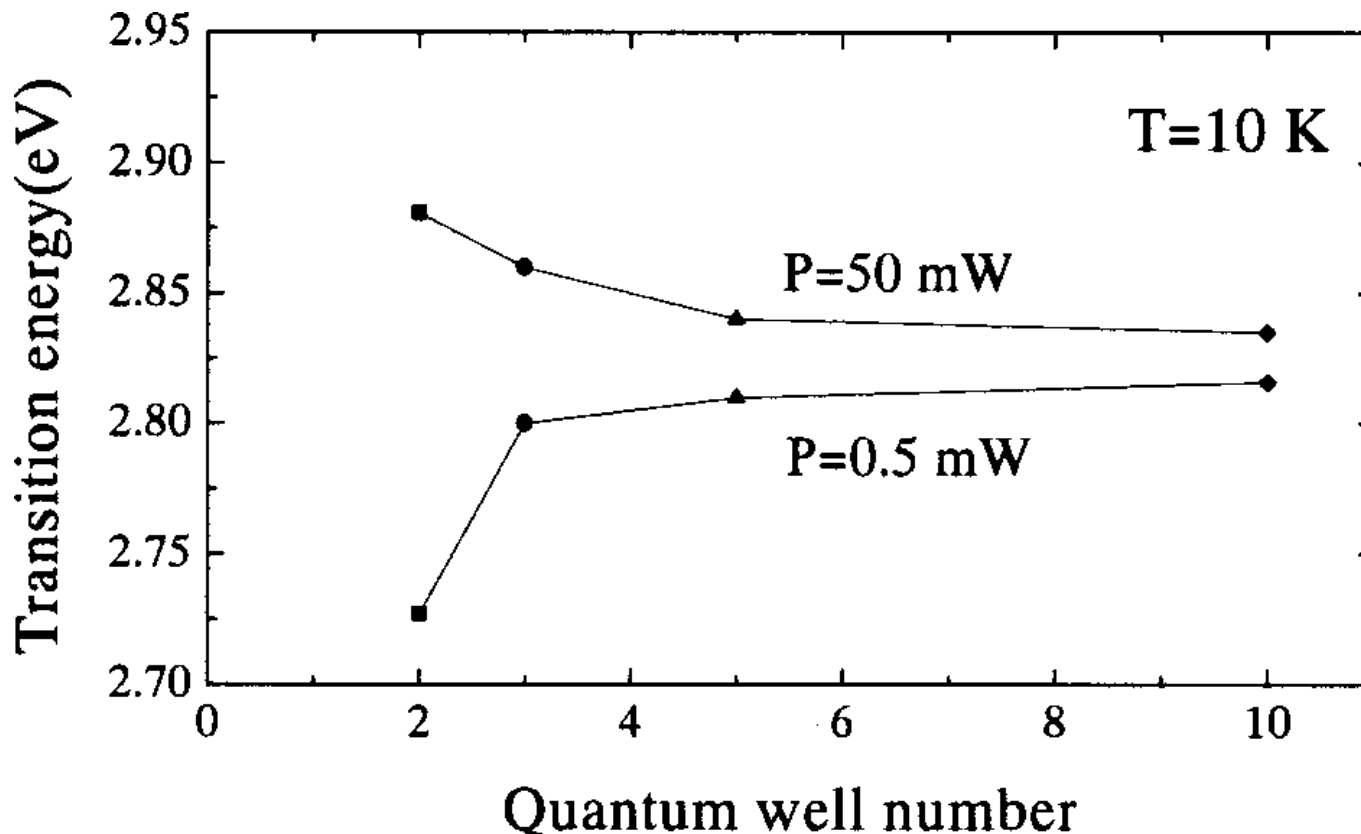
- FIG. 2. Photoluminescence spectra of four InGaN/GaN MQW structures with 2, 3, 5, and 10 periods, measured at 10 K under an excitation power of 0.5 mW.

Result and Discussion



- FIG. 3. Excitation power dependent photoluminescence of InGaN/GaN MQWs with 2(a) and 10(b) periods at $T=10\text{ K}$.

Result and Discussion



- FIG. 4. Emission energy of an InGaN/GaN MQW as a function of quantum well number under lower excitation power ~ 0.5 mW! and high excitation power ~ 50 mW!, both measured at 10 K.

Result and Discussion

$$E_{pz} = \frac{2}{\epsilon_r \epsilon_0} \left(\frac{c_{13}}{c_{33}} e_{33} - e_{31} \right) \epsilon_{xx}$$

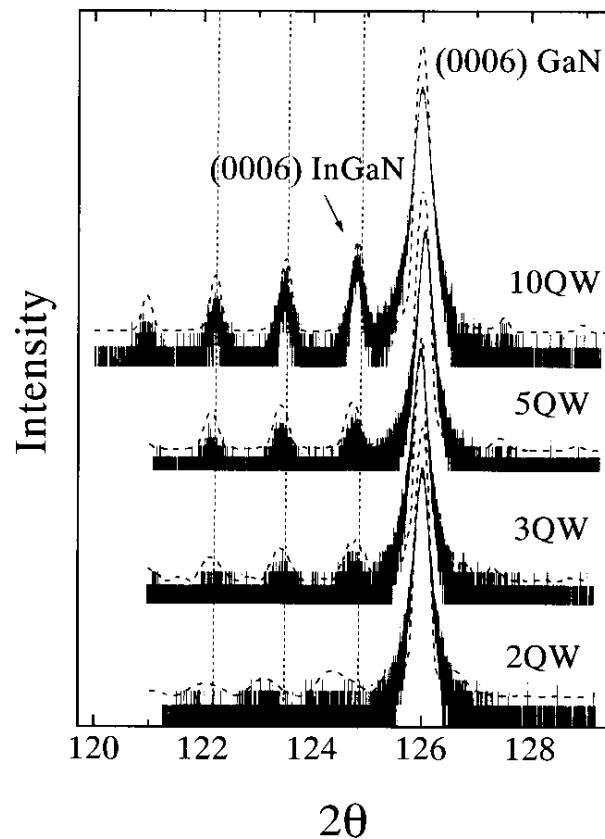
↑
Residual strain

Result and Discussion

Sample	2QW	3QW	5QW	10QW
Residual strain	100%	51%	46%	40%

- TABLE I. Residual strain in InGaN/GaN MQW structures with 2, 3, 5, and 10 periods, respectively. The elastic constants used are also listed.

Result and Discussion



- FIG. 5. Measured and simulated XRD patterns of InGaN/GaN MQW structures based on (0006) $2u - v$ mode. The quantum well numbers of the InGaN/GaN MQWs are 2, 3, 5, and 10, respectively. The dashed lines correspond to simulated curves.



Conclusion

- With increasing quantum well number, the emission energy shows a clear blue shift, which is attributed to strain relaxation.
- Strain relaxation starts to take place from three-period MQWs.

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Thanks for your attention !