

# MODIFICATION OF OPTICAL PROPERTIES OF Si<sub>1-x</sub>Ge<sub>x</sub>/p-Si<100> MQWs GROWN BY LPCVD FOR PHOTONIC APPLICATIONS

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## ABSTRACT

Group-IV semiconductor heterostructures such as Si/SiGe and Si/SiGeC are being intensively studied due to their potential for various device applications and compatibility with the advanced Si technology. These heterostructures are expected to lead to not only improvements of the performance of current Si electronic and photonic devices but also to realize various new functionalities. One of the important factor when designing Si/SiGe materials system for photonic applications is the ability to modify their optical properties to suit the application's needs. This work aims to modify the refractive index of Si/SiGe MQWs. This work used 10-period multiple quantum wells of Si<sub>0.94</sub>Ge<sub>0.06</sub>/p-Si<100> and Si<sub>0.8</sub>Ge<sub>0.2</sub>/p-Si<100>, both with 5nm well width and were grown using LPCVD technique. A special temperature treatment method was then applied on the samples. The method was also applied on the n-type and p-type Si<100> as controls. The effects of the treatment were recorded using AFM and ellipsometry. AFM spectrum in Figure 1 shows that treated Si samples have better surface uniformity than untreated samples. Figure 2 shows the variation of complex refractive index (N<sub>com</sub>) with exposure time for Si samples. Figure 3 shows the change of optical properties of the temperature treated Si<sub>0.94</sub>Ge<sub>0.06</sub>/p-Si<100> MQWs and Si<sub>0.8</sub>Ge<sub>0.2</sub>/p-Si<100> MQWs. The properties change in MQWs with 6%Ge is more significant than that of 20%Ge in response to the treatment. The explanation for the change of optical properties of Si/SiGe MQWs will be discussed.

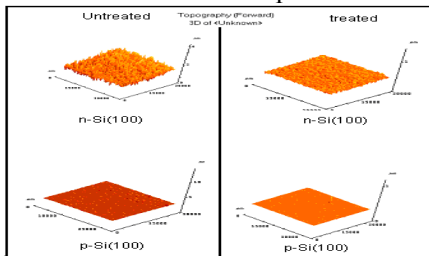


Fig.1: AFM images of untreated and untreated Silicon samples.

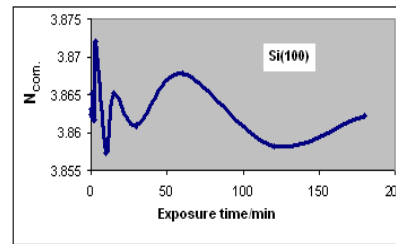


Fig.2: Complex refractive index, Ncom, versus exposure time at Brewster angle.

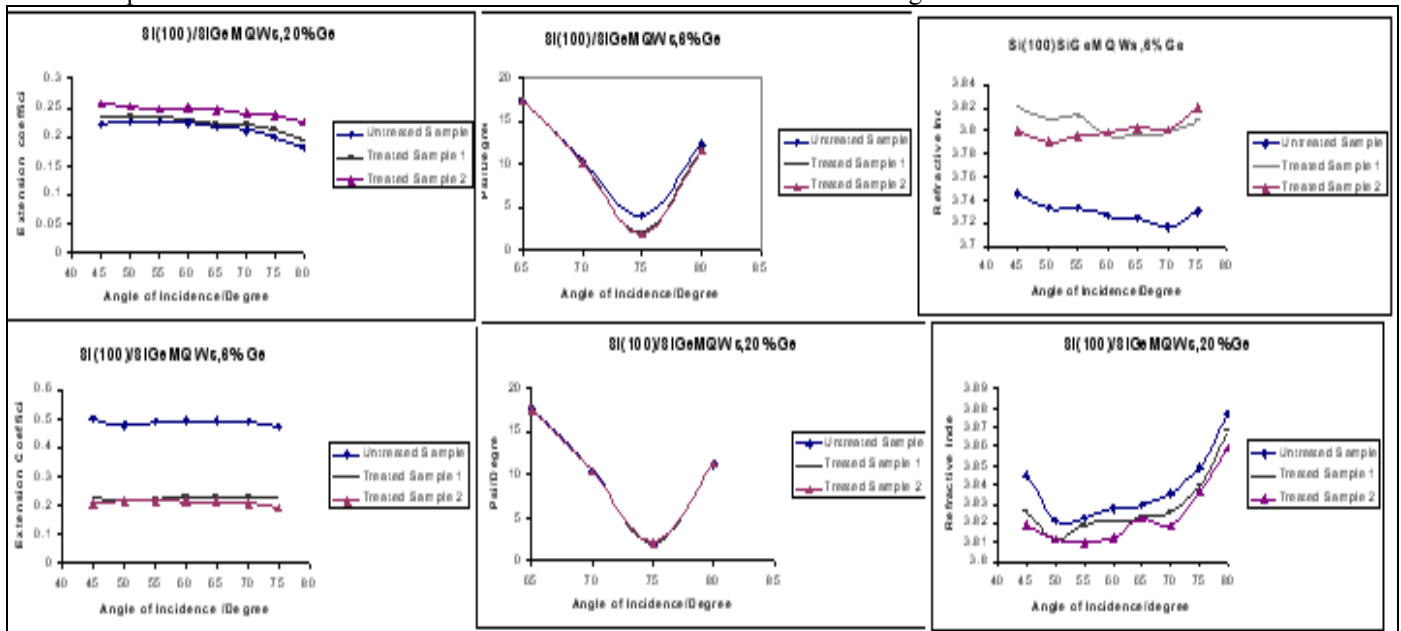


Fig.(3):Ellipsometry results of the treated and untreated 10-period 5nm MQWs SiGe/p-Si(100)

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