

마이크로 공진기와 표면 방출 레이저 제작을 위한 갈륨비소
실리콘 기판위의 3족 질화물 에피필름

Group 3 Nitride epilayers on GaN-silicon substrates for
microcavities and surface emitting lasers

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Fabrication of GaN microcavities or surface emitting lasers (SELs) is challenging one. Reason is mainly because it requires high reflective AlGaIn/GaN semiconductor distributed Bragg reflectors (DBRs) or GaN epilayer's separation from the substrate.⁽¹⁻²⁾ Recent demonstration of GaN epilayer growth on silicon substrate gives new possibility in this challenging because we can use the well-known Si selective etching technique.⁽³⁾ We show the processing of GaN epilayer on GaN-Si substrate for microcavities or SELs. With the sample of InGaIn/GaN MQWs on 1 μ m as-grown GaN buffer-Si substrate, we were able to obtain the flat membrane without wrinkles after the selective wet etching of Si substrate. In order to remove AlN buffer layer on the membrane and to minimize the GaN buffer layer of the membrane which is acted as absorption in QW emission, we used inductively coupled plasma (ICP) etcher. The processes of removing oxidation contamination were delicately conducted and then AlN and GaN layers on membrane were etched with the same etching gas of Cl₂. Using atomic force microscope (AFM) we investigated the surface roughness quality of etched side. After ICP etching, the membrane of total thickness 1.2 μ m, which consisted of 16 InGaIn/GaN MQWs and GaN buffer, were obtained with a good physical quality and surface roughness quality for further optical usage. With photo luminescence (PL) measurements on the sample, we observed a wavelength red shift on membrane PL emission, which is due to strain relaxation. With dielectric DBR deposition on this membrane, we plan to fabricate GaN Vertical external cavity surface emitting lasers (VECSELs) and Vertical cavity surface emitting lasers (VCSELs) for optical pumping.

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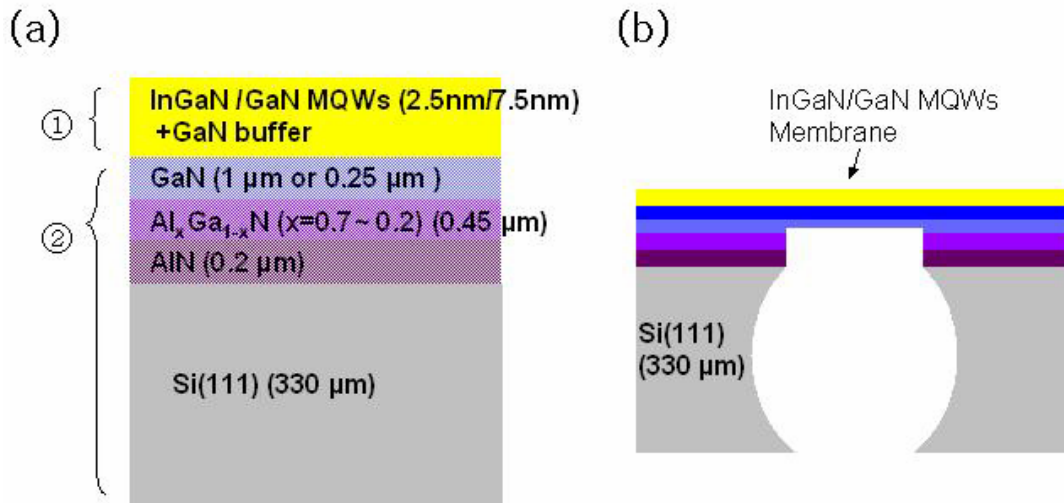


Fig 1 The schematic diagram of (a) the prepared sample and (b) the processed sample after the whole processing.

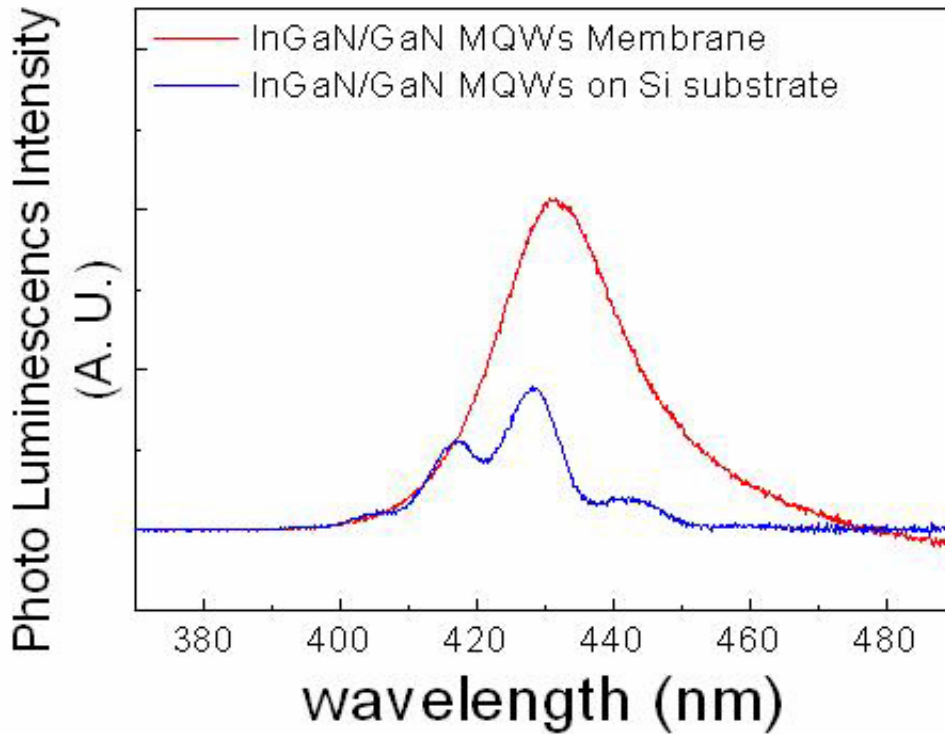


Fig. 2 InGaN/GaN 16MWQs PL emission spectrum of original sample and of membrane sample