Abstract Submitted
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Silicon quantum dots LED with external quantum efficiency of 2% GUN YONG SUNG, ETRI, KWAN SIK CHO, ETRI, NAE-MAN PARK, TAE-YOUB KIM, ETRI, KYUNG-HYUN KIM, ETRI, NEW FUNTIONAL INFORMATION DEVICE TEAM — There has been much effort to solve the inability of silicon to act as a light emitting source such as porous silicon,Er doped silicon, and silicon nanocrystals(nc-Si). Among these, nc-Si dispersed in SiO_2 matrix has attracted a great interest because their band gap is enlarged in comparison with bulk silicon due to quantum confinement effects. Previously, we reported that red to blue PL were observed from amorphous silicon quantum dots in silicon nitride matrix.[1,2] Therefore nc-Si in silicon nitride matrix supplies the possibility of Si-based full-color emission. We have fabricated LEDs with a transparent doping layer on nc-Si embedded in silicon nitride matrix formed by plasma-enhanced chemical vapor deposition. Under forward biased condition, orange EL with its peak wavelength at about 600nm was observed at room-temperature. The peak position of the EL is very similar to that of the PL and the emitted EL intensity is proportional to the current density passing through the device. We suggest that the observed EL is originated from electron-hole pair recombination in nc-Si. By using ITO and n-type wide bandgap semiconducting layer combination as a transparent doping layer, we obtained high external quantum efficiency greater than 2.0%, which is the highest value ever reported in nc-Si based LED. [1] Nae-Man Park et al., Phys. Rev. Lett. 86, 1355 (2001) [2] Tae-Youb Kim et al., Appl. Phys. Lett. (2004), in press.

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