Proceedings of the 4th World Congress on New Technologies (NewTech'18)
Madrid, Spain – August 19 – 21, 2018
Paper No. ICNFA 126
DOI: 10.11159/icnfa18.126

Surface Modified InGaN/Si(111) Photoanode For Efficient Photoelectrochemical Water-Splitting

Praveen Kumar[1], Pooja Devi[2]
[1]Materials Science, Indian Association for the Cultivation of Science
Kolkata -700030, India
msprk@iacs.res.in
[2]Central Scientific Instruments Organization, Sector-30C
Chandigarh- India-160030
poojaiitr1987@gmail.com

Extended Abstract

Numerous materials including Oxides, Phosphide, Arsenide, nitrides etc have been reported for hydrogen generation by photoelectrochemical (PEC) water splitting with limited success, however, among them III-nitrides have been attracted a great attention due to their advanced properties such as high absorption coefficient, high stability, bandgap tuning and straddling with the water redox etc. The reported photoelectrodes have mostly grown using either buffer layers or external catalyst on GaN epilayers, which makes the fabrication of these electrodes costly. We herein will demonstrate our recent results on the development of the III-nitride based photoanode grown directly on Si substrate. We will demonstrate two photoanodes namely, 1) InGaN layers directly grown on Si(111) substrate and 2) the modified InGaN layers with the InN QDs to improve the overall efficiency. Both the optimized photoanode were ex-situ characterized by FESEM & AFM (morphological), HRXRD (structural), PL (optical) and I-V (electrical), further subjected to evaluate their PEC water splitting performance under three/two electrode setup. The results manifest the efficiency enhancement for hydrogen evolution by the InN QDs, with the applied-bias photon-to-current efficiency of 4.1 % at 0.2 V. This enhancement is attributed to a decrease in the built-in potential at the interface. The maximum incident photon-to-current-conversion efficiency (IPCE) for modified photoelectrode is 44% . These results open new possibilities to integrate the III-nitrides based photoelectrodes with the well-established Si technologies.

Acknowledgements

PK acknowledges the registration and travel support of the Marie Curie Alumni Association (MCAA).

References

[1] P. E. D. S. Rodriguez, V. C. Nash, P. Aseev, V. J. Gómez, P. Kumar, N. H. Alvi, A. Sánchez, R. Villalonga, J. M. Pingarrón and R. Nötzel, *Electrochemistry Communications*, vol. 60, p. 158, 2015.
[2] P. E. D Soto, P. Aseev, V. J Gómez, Praveen Kumar, N. H. Alvi, E. Calleja, J. M. Mánuel, F. M. Morales, J. Jiménez, R. García, A. Senichev, C. Lienau, R. Nötzel, *Applied Physics Letters*, vol. 106, p. 023105, 2015.
[3] N. H. Alvi, P. E. D. Soto Rodriguez, P. Kumar, V. J. Gómez, P. Aseev, M. Willander, and R. Nötzel, *Applied Physics Letter*, vol. 104, p. 223104, 2014.
[4] P. Kumar, P. E. D. Soto Rodriguez, V. J. Gómez, N. H. Alvi, E. Calleja and R. Notzel, *Applied Physics Express*, vol. 6, p. 035501, 2013.