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Enhanced surface passivation effect in porous GaN for high performance H₂ gas sensors at room temperature

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Diatomic hydrogen is a colorless, odorless, and tasteless gas which, when combined with air, poses a safety hazard due to its wide flammability range where high burning velocities and explosive tendencies compound the risks. At high concentrations it can also act as an asphyxiant. Its importance stems primarily from its use as a reactant for the chemical industry in the processing of ammonia, petrochemicals, and methanol. Effective H₂ sensors that can quickly and sensitively respond to H₂ gas are crucial for the safe deployment of all hydrogen-based applications. Ideally, a H₂ gas sensor should be compact, sensitive, and durable, have short response times, and be simple to fabricate. We describe the fabrication of porous GaN prepared by metal electroless etching method. Then, porous GaN was treated by octadecylthiol (ODT) for the passivation of the surface states. At room temperature, the passivation of the porous GaN sample enhance the detection of H₂ gas. After passivation using ODT, the sample show excellent selectivity compared to other gases (i.e. H₂S, C₂H₄). Simultaneously, this sensors exhibited good sensing repeatability and stability. This enhancement in gas sensing properties after passivation was attributed to the effect of ODT to reduce the surface states effect. The attractive low-cost, low power consumption and high performance of the resultant passivation porous GaN gas sensor assure their potential application for H₂ gas sensor working at low temperature.

Biography

Adel Najar received his PhD in Physics at ENSSAT- Rennes 1 University in France and MBA from Beuth Hochschule Fur Technik Berlin in Germany in 2007 and 2016, respectively. He served as a post-doctorat at Saint-Gobain Research Company in collaboration with Grenoble Institute of Technology in France, a Research Scientist at LETI at the Alternative Energies and Atomic Energy Commission (CEA) in France as well as at KAUST in Saudi Arabia, and Senior Research Scientist at Atsugi R&D Center, NTT Corp. in Japan. From 2015, Dr. Najar appointed as faculty in UAE University in UAE. His main research interests is the development of semiconductor nano-structure for photonics and nanophotonics application. Dr. Najar is an author and co-author of more than 50 papers in peer-reviewed journals, conferences, book chapter and patents.

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