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Meet the Inventors

[Garcia, Michael](#)
[Bonaventura, Joseph](#)
[Brown, April](#)
[Kuech, Thomas](#)
[Wolter, Scott](#)

Contact For More Info

Koi, Bethany
919-681-7552
bethany.koi@duke.edu

Department

Electrical & Computer Engineering (ECE)

GaN-based nitric oxide sensors and methods of making and using the same

Technology

GaN-based heterojunction field effect transistor (HFET) sensors are provided with engineered, functional surfaces that act as pseudo-gates, modifying the drain current upon analyte capture. In some embodiments, devices for sensing nitric oxide (NO) species in a NO-containing fluid are provided which comprise a semiconductor structure that includes a pair of separated GaN layers and an AlGaIn layer interposed between and in contact with the GaN layers. Source and drain contact regions are formed on one of the GaN layers, and an exposed GaN gate region is formed between the source and drain contact regions for contact with the NO-containing fluid. The semiconductor structure most preferably is formed on a suitable substrate (e.g., SiC). An insulating layer may be provided so as to cover the semiconductor structure. The insulating layer will have a window formed therein so as to maintain exposure of the GaN gate region and thereby allow the gate region to contact the NO-containing fluid. Electrical contact pads are preferably provided in some embodiments so as to be in electrical contact with the source and drain contact regions, respectively. Electrical leads may thus be connected to the contact pads. According to other embodiments, the NO detection device will include a metalloporphyrin adsorbed on the GaN gate region.

