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Abstract for an Invited Paper  
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**David Adler Lectureship Award in the Field of Materials Physics Talk: Novel Nitride and Oxide Electronics<sup>1</sup>**  
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Recent progress in development of GaN-based transistors for gas and bio-sensing applications and amorphous IGZO layers for use thin film transistors (TFTs) on flexible substrates, including paper, will be presented. For the detection of gases such as hydrogen, the gateless GaN transistors are typically coated with a catalyst metal such as Pd or Pt to increase the detection sensitivity at room temperature. Functionalizing the surface with oxides, polymers and nitrides is also useful in enhancing the detection sensitivity for gases and ionic solutions. The use of enzymes or adsorbed antibody layers on the semiconductor surface leads to highly specific detection of a broad range of antigens of interest in the medical and security fields. We give examples of recent work showing sensitive detection of glucose, lactic acid, prostate cancer and breast cancer markers and the integration of the sensors with wireless data transmission systems to achieve robust, portable sensors. The amorphous transparent conducting oxide InZnGaO<sub>4</sub> (IGZO) is attracting attention because of its high electron mobility (10-50 cm<sup>2</sup>.V<sup>-1</sup>.sec<sup>-1</sup>), high transparency in the visible region of the spectrum and its ability to be deposited with a wide range of conductivities. This raises the possibility of making low-cost electronics on a very wide range of arbitrary surfaces, including paper and plastics. N-type oxides such as zinc oxide, zinc tin oxide, indium gallium oxide, and indium gallium zinc tin oxide (IGZO) exhibit surprisingly high carrier mobilities even for amorphous films deposited at 300K. This has been explained by the fact that the conduction in these materials is predominantly through non-directional s orbitals which are less affected by disorder than the directional sp<sup>3</sup> orbitals which control electron transport in Si. Examples of progress and discussion of remaining obstacles to use of IGZO TFTs will be presented

<sup>1</sup>Work performed in collaboration with Fan Ren.