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Method for In-Situ Etching of Ga2O3 using Metal Organic Ga Precursors

Background

Gallium oxide (Ga2O3) is an ultra-wide band gap semiconductor that has potential to be useful in power switching and high-frequency power amplifying devices. However, all current dry etching recipes in Ga2O3 have been found to cause significant subsurface damage, resulting in charge depletion. Additionally, wet etching recipes for Ga2O3 have been found to form angled sidewalls, making it difficult to form highly scaled (~100nm) fins/trench structures. In addition to traditional wet and dry etch processes, metal assisted chemical etching using platinum (Pt) was also demonstrated as an etch method for gallium oxide. However, the etched surfaces were found to be non-stoichiometric leading to reduced Schottky barrier heights.

Invention Description

Researchers at Arizona State University have developed a novel method for damage-free in-situ etching of gallium oxide (Ga2O3) using metal organic gallium precursors including Triethyl gallium (TEGa) or Trimethyl gallium (TMGA) inside a metal organic chemical vapor deposition (MOCVD) reactor. In this method, the sample is heated to a high temperature (>600 C), then the metal organic precursor is supplied into the reactor at a specific flow rate controlled by a mass flow controller. The Gallium that lands on the surface of the substrate results in damage-free etching of the Ga2O3 surface.

Potential Applications

- Power switching
- High frequency power amplifying devices
- High-temperature gas sensors

Benefits and Advantages

- Damage-free etching of Ga2O3 – enables fabrication of diverse device architectures
- Enables clean etch and regrowth processes in Ga2O3
- Parameters can be varied for different outcomes – molar flow rate, substrate temperature, and chamber pressure can be adjusted based on application

Related Publication: Demonstration of MOCVD based in situ etching of B-Ga2O3 using TEGa.