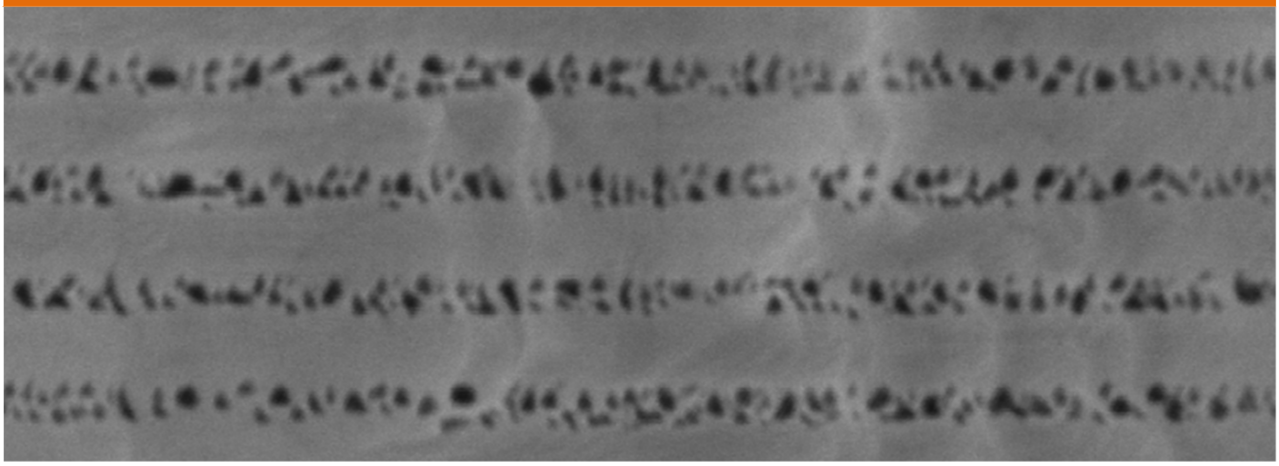
Mesoporous GaN substrates with tunable properties

Ready-to-use porous GaN



Dr Rachel Oliver and her team in the Department of Materials & Metallurgy, University of Cambridge, have developed an electrochemical etching method to produce layered porous GaN wafers with epi-ready surface properties. This is expected to enable a new paradigm in device manufacture by growing devices directly on the surface of the layered porous GaN wafers. The team is now keen to collaborate with suitable partners for development of the technology.

Key Benefits

- Simple electrochemical etching method works on industrial size wafers
- Produces porous GaN with an intact surface ready for device growth – simple device manufacture
- Wafers can be used for a variety of devices, and the sub-surface sequence of porous and non-porous layers can be varied to achieve any desired design

Dr Oliver's research focuses on the characterisation and exploitation of nanoscale structures in GaN-based materials. The aim is to achieve improved performance in GaN-based optoelectronic devices and to develop and implement novel device concepts.

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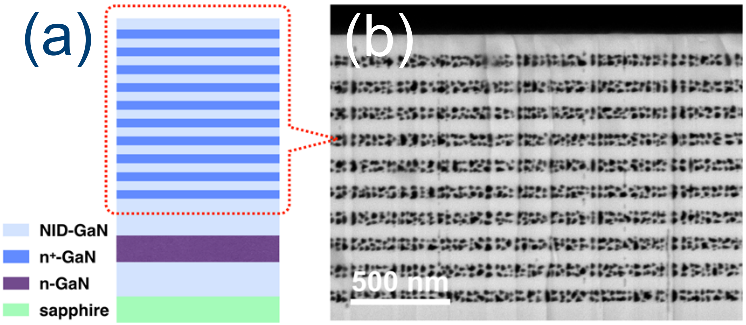

Figure 1: (a) Schematic of a distributed Bragg reflector (DBR) structure. (b) Cross-sectional SEM image of the 10 pair GaN/MP-GaN DBR structure.

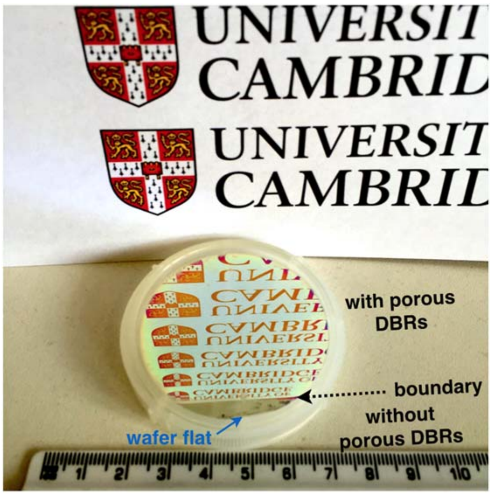

Figure 2: Photograph of an as-etched 2-inch mesoporous GaN DBR wafer reflecting a card with the University of Cambridge logo.

What are the features of the wafers?

The novel etching method allows for vertical etching of commercial GaN wafers while leaving the surface of the wafer in a pristine condition. Figure 1 shows how the etching process can be used to form layers of porous GaN and non-intentionally doped GaN. The process can create any sub-surface sequence of porous and non-porous layers that is desired. Additionally, it has the potential to produce these structures over many layers and large thicknesses, all while leaving the surface structure intact. The process works independently of the substrate the GaN is grown on.

Applications

The range of devices the wafers could be used for is broad. One design of the porous GaN wafers make ideal distributed Bragg reflectors (DBR) and the porosity of the wafers can be controlled during etching to change the wavelength of the reflectance. Figure 2 is a photograph of an etched wafer, showing its reflecting properties.

The pristine surface allows for growth of devices directly on the surface, such as an LED, which could simplify the production of GaN light emitters. These wafers could also be used in the manufacture of next generation GaN power electronics. Ultimately, the flexibility of porous layering could open up previously unforeseen applications.

Next steps

This technology is protected by a PCT patent application. We are now looking for partners to help us develop the method and wafers for a range of applications. Please contact us using the information on the front page if you would like to explore this opportunity.