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Multilayer porous structures on GaN for the fabrication of Bragg reflectors

Tudor Braniste, Eduard Monaico, Denis Martin, Jean-François Carlin, Veaceslav Popa, Veaceslav V. Ursaki, Nicolas Grandjean, Ion M. Tiginyanu

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Abstract

We report on the development of electrochemical etching technology for the production of multilayer porous structures (MPS) allowing one to fabricate Bragg reflectors on the basis of GaN bulk substrates grown by Hydride Vapor Phase Epitaxy (HVPE). The formation of MPS during anodization is caused by the spatial modulation of the electrical conductivity throughout the surface and the volume of the HVPE-grown GaN substrate, which occurs according to a previously proposed model involving generation of pits and their overgrowth. We found that the topology of the porous sheets constituting the MPS is different in the vicinity of N-face and Ga-face of the bulk wafer, it being of conical shape near the N-face and of hemispherical shape near the Ga-face. The composition of electrolytes, their concentration as well as the anodization potential applied during electrochemical etching are among technological parameters optimized for designing MPS suitable for Bragg reflector applications. It is shown also that regions with various porosities can be produced in depth of the sample by changing the anodization potential during the electrochemical etching.