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Lithography-free microfabrication of AlGa_N/Ga_N 2DEG strain sensors using laser ablation and direct wire bonding

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Abstract

This work presents a simple and rapid lithography-free (i.e., maskless) microfabrication process for strain-sensitive aluminum gallium nitride (AlGa_N)/Ga_N sensors. We microfabricated an AlGa_N/Ga_N strain sensor through laser ablation of the underlying Si (111) substrate and direct bonding of aluminum wires to the AlGa_N surface, creating a Schottky contact to the two-dimensional electron gas (2DEG). We measured the sensor's current-voltage operation while displacing the center of the membrane up to 106.7 μm and characterized its sensitivity at from 0.5 to 2 V bias (i.e., 5 to 100 nA/ μm). This work advances the development of AlGa_N/Ga_N-on-Si microelectronics (e.g., pressure sensors, accelerometers, and gyroscopes) using the simplified fabrication process, which eliminates lithography, metallization, and etching, and reduces the manufacturing time (5 min) and cost, as well as the need for cleanroom environments.

Keywords: *Gallium nitride, Microfabrication, Strain sensor, Laser ablation, Direct wire bonding*

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