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Ultra-thin semiconductor membrane nanotechnology based on surface charge lithography

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Abstract

We show that by subjecting GaN epilayers on sapphire substrates to low-energy/low-dose ion treatment with subsequent photoelectrochemical etching it is possible to fabricate ultra-thin GaN membranes in the form of nano-roof hanging over networks of whiskers representing threading dislocations. The suspended membranes prove to be transparent to both UV-radiation and keV-energy electrons, their architecture being dependent upon the stirring conditions of the electrolyte during electrochemical etching. The obtained results are indicative of electrical conductivity, flexibility and excellent mechanical stability of ultra-thin GaN membranes characterized by prevailing yellow cathodoluminescence.