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Expanding the versatility of silicon carbide thin films and nanowires¹

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Silicon carbide (SiC) based electronics and sensors hold promise for pushing past the limits of current technology to achieve small, durable devices that can function in high-temperature, high-voltage, corrosive, and biological environments. SiC is an ideal material for such conditions due to its high mechanical strength, excellent chemical stability, and its biocompatibility. Consequently, SiC thin films and nanowires have attracted interest in applications such as micro- and nano-electromechanical systems, biological sensors, field emission cathodes, and energy storage devices. However to fully realize SiC in such technologies, the reliability of metal contacts to SiC at high temperatures must be improved and the nanowire growth mechanism must be understood to enable strict control of nanowire crystal structure and orientation. Here, we present a novel metallization scheme, utilizing solid-state graphitization of SiC, to improve the long-term reliability of Pt/Ti contacts to polycrystalline n-type SiC films at high temperature. The metallization scheme includes an alumina protection layer and exhibits low, stable contact resistivity even after long-term (500 hr) testing in air at 450 °C. We also report the crystal structure and growth mechanism of Ni-assisted silicon carbide nanowires using single-source precursor, methyltrichlorosilane. The effects of growth parameters, such as substrate and temperature, on the structure and morphology of the resulting nanowires will also be presented. Overall, this study provides new insights towards the realization of novel SiC technologies, enabled by advanced electron microscopy techniques located in the user facilities at the Molecular Foundry in Berkeley, California.

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