

Nanoelectronics Based on Graphene and Beyond

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Abstract

Graphene has attracted much interest as a future channel material in high-frequency electronics because of its superior electrical properties. Recent development has been shifted from the device level study to the circuit level demonstration. I will review and discuss several key challenges for large-scale graphene device fabrication, including high quality gate dielectric, large-area film transfer, and output current saturation. I will discuss our effort of developing graphene IC in the past few years, starting with a simple 1-stage mixer built on a SiC piece, toward the recent demonstration of a high-performance three-stage graphene IC that fully preserves graphene transistor quality post-IC fabrication. Beyond graphene, more suitable 2D materials with energy bandgap for electronics applications are being aggressively investigated. I will discuss some recent progress of transition metal dichalcogenides and black phosphorus based transistors in my group. In addition, other applications such as plasmonics and photodetectors using these novel 2D materials will be discussed.