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Graphene Nanoconstriction Field Effect Transistor[1] YE LU, BRETT GOLDSMITH, University of Pennsylvania, DOUGLAS STRACHAN, University of Kentucky, A.T. CHARLIE JOHNSON, University of Pennsylvania, UNIVERSITY OF PENNSYLVANIA TEAM, UNIVERSITY OF KENTUCKY TEAM
— We report an approach to fabricate monolayer graphene nanoconstriction field effect transistors (NCFETs) with critical dimensions below 10 nm, a regime that is not accessible by conventional nanolithography. We start by fabricating a gold nanowire on top of mechanically-exfoliated monolayer graphene. We use Feedback Controlled Electromigration to form a nanoconstriction in the gold wire, which is then used as an etch mask for the graphene during an oxygen plasma patterning step. We observe the opening of a confinement-induced energy gap as the NCFET width is reduced, as evidenced by a sharp increase in the NCEFT on/off ratio, which can be as large as 1100 at room temperature for the thinnest devices. Such devices deliver up to 100microampere current at 50mV bias with an on state resistance of 50kilo ohm, which is at least an order of magnitude lower than graphene nanoribbon FETs with similar on/off ratio. This lower resistance is due to large area contacts in our devices.

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