Abstract Submitted
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Single/Bi-layer Silicene Field-Effect Transistors and their Air-Stability LI TAO, Microelectronics Research Center, The University of Texas at Austin, Texas 78758, USA, EUGENIO CINQUANTA, CARLO GRAZIANETTI, ALESSANDRO MOLLE, Laboratorio MDM, IMM-CNR, via C. Olivetti 2, Agrate Brianza, I-20864, Italy, DEJI AKINWANDE, Microelectronics Research Center, The University of Texas at Austin, Texas 78758, USA — Silicene, the Si analogue of graphene, has the potential to be a widely tunable 2D material for novel nano-electronics. Air-stability is a major issue for experimental investigation on silicene devices, which per this study has been greatly addressed by our encapsulated delamination with native electrodes (SEDNE) approach. SEDNE process preserves silicene/Ag interface during transfer and fabrication, and real-time Raman spectroscopy observes a short time window for Ag-removed silicene device stays intact and gradually degrades. In our predefined experiments, silicene devices exhibit an ambipolar charge transport behavior, corroborating theories on Dirac band in Ag-free silicene. Monolayer silicene device has extracted field-effect mobility within the theoretically predicted range and ON/OFF ratio greater than graphene, whereas bi-layer silicene device shows lower mobilities and gate modulation similar to graphene. This work suggests a realistic prospect for improving air-stability of silicene devices and its tunable performance, which can be leveraged for other air-sensitive 2D materials. *Support from U.S. Army Research Office (W911NF-131-0364) and Future Emerging Technologies (270749) under European Commission are appreciated.

Li Tao
The University of Texas at Austin

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