

Large-scale complementary macroelectronics using hybrid integration of carbon nanotubes and IGZO thin-film transistors

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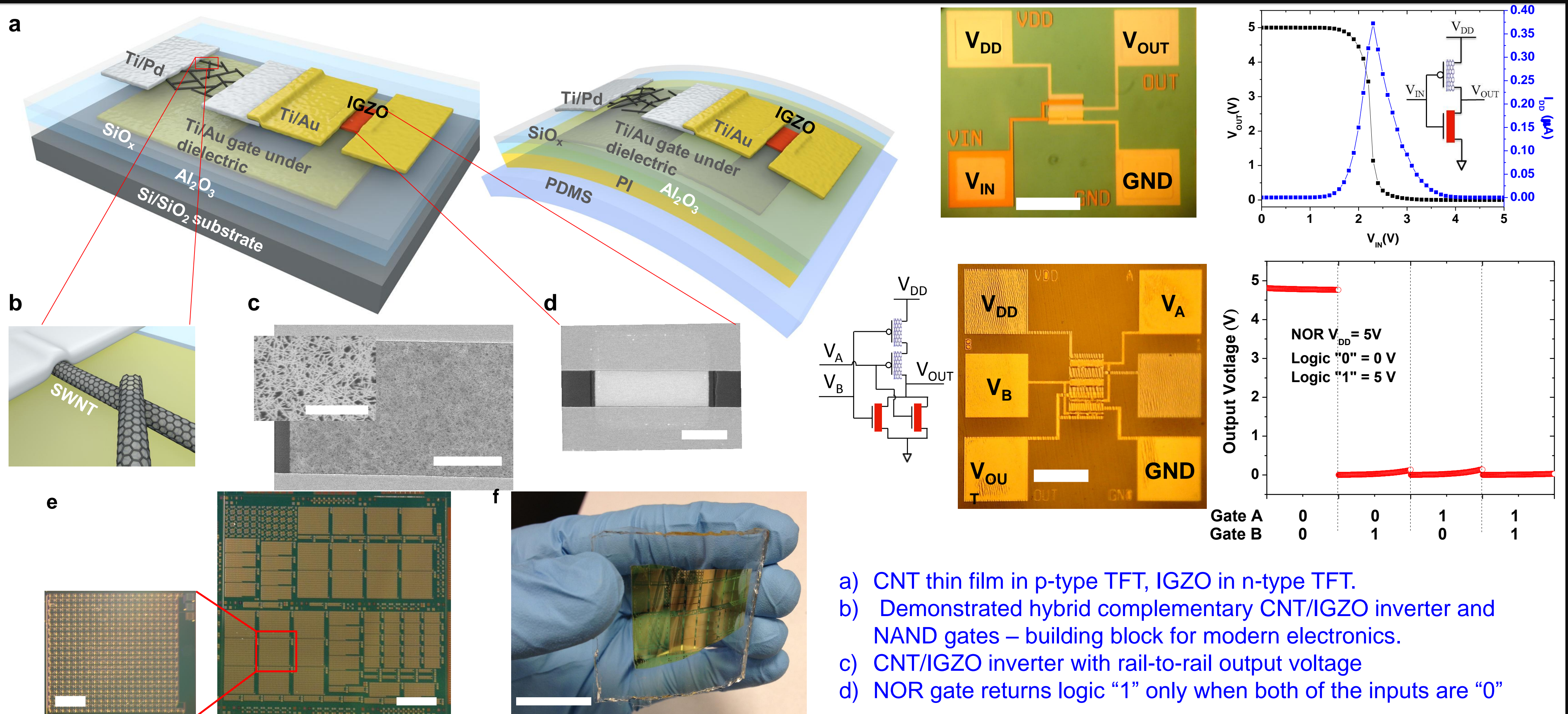
Carbon Nanotube - The Future of Macroelectronics and Flexible Macroelectronics

- Carbon nanotube (CNT) TFT Mobility (**40 cm²/Vs**) ; CNT TFT high operational stability; CNT TFT flexible , transparent and printable.
- CNT TFT is **p-type** – difficult to obtain **n-type** for complementary mode circuits, which exhibit low steady state power dissipation property.
- Oxide semiconductor TFT, indium gallium zinc oxide (IGZO) is **n-type** TFT - Difficult to obtain stable **p-type** TFT.

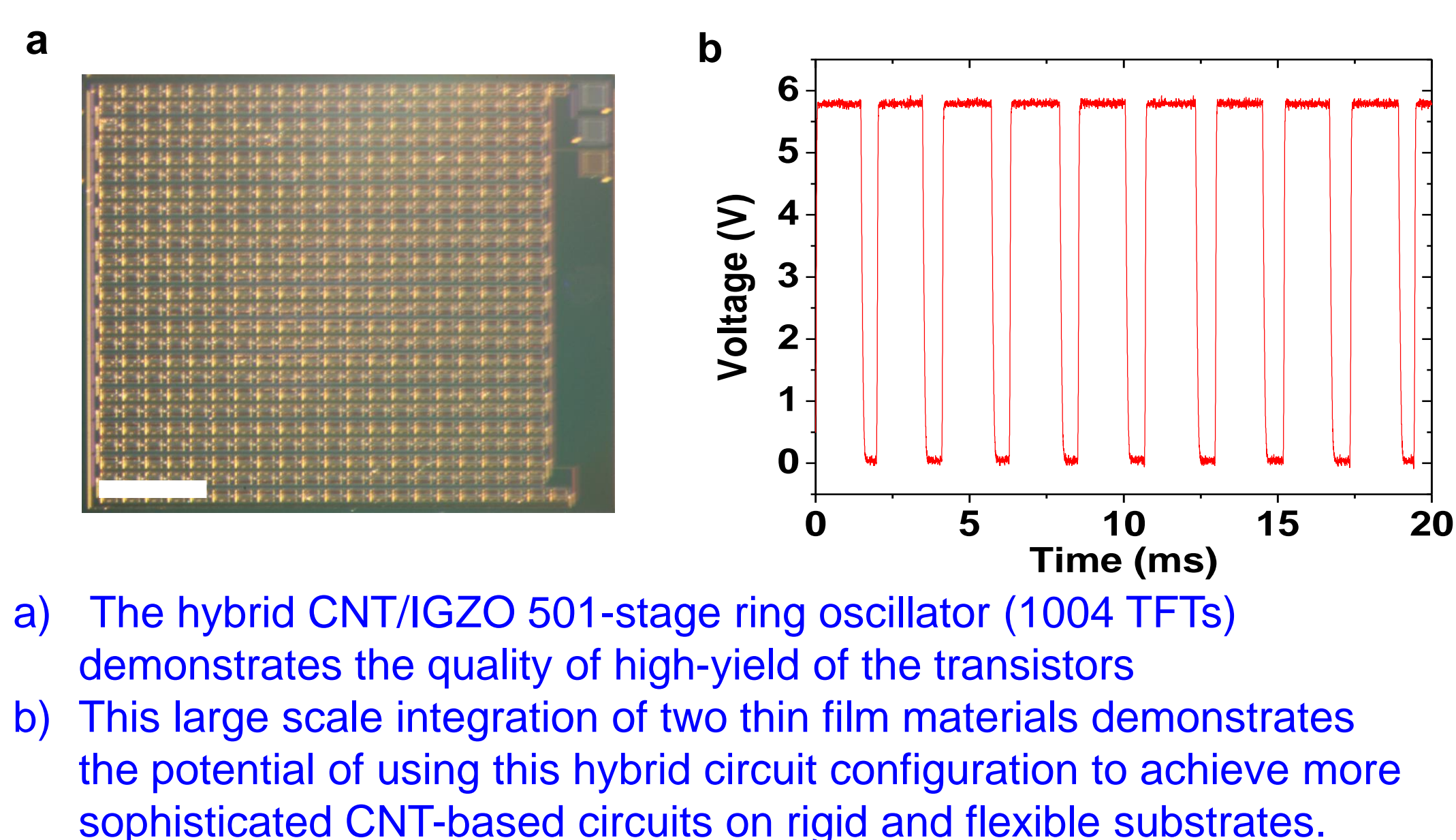


- 1) [Hybrid integration scheme to achieve robust complementary macroelectronics using CNT/IGZO TFTs](#)
- 2) [Complementary hybrid CNT/IGZO inverter, NAND and NOR gates on rigid and flexible substrates](#)
- 3) [Large scale \(>1000 TFTs\) complementary hybrid CNT/IGZO ring oscillators](#)

CNT/IGZO complementary inverter and NAND gate on rigid and flexible substrate



501-stage (1004 TFTs) ring oscillator



Discussion & Future Work

- 1) We have demonstrated circuits operating in complementary mode based on CNT and IGZO thin film transistors.
- 2) We have successfully demonstrated various logic gates using this structure on both rigid and flexible substrates.
- 3) We have demonstrated the first large scale (>1000 TFTs) integrated macroelectronic based on CNT/IGZO TFTs

Future Work:

- 1) Using CNT/IGZO complementary circuits as control circuitry for flexible pixel driver for AMOLED
- 2) Improve performance of CNT TFTs.