

Multivalued logic circuit with organic FET

Keywords: Organic field-effect transistor, logic circuit, pn-heterointerface

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Background

- Compatibility of mechanical flexibility and data processing capability
- Novel approach to increase integration density in the field of organic electronics
- New concept of device operation mechanism

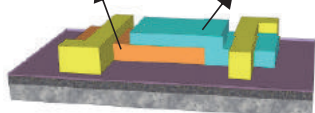
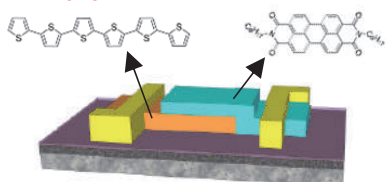
Aim

- To improve data processing capability of organic electronics
- To develop a multivalued logic circuit on flexible substrate
- To explore new transistor configuration and operation mechanism

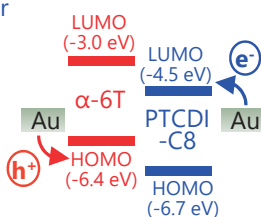
Advanced Research Topics

p-type semiconductor α -6T

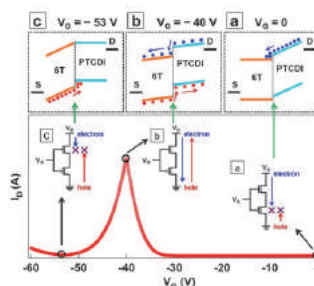
n-type semiconductor PTCDI-C8



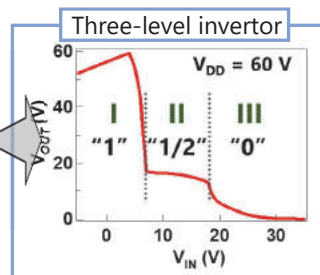
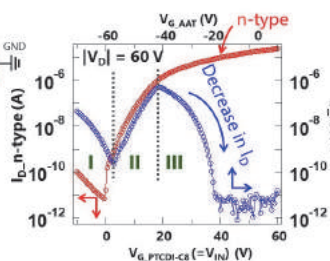
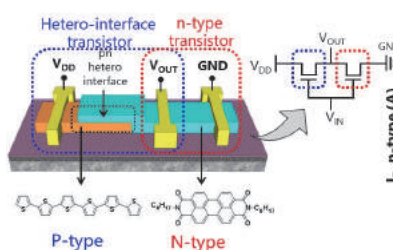
Novel OFET structure with pn-heterointerface



Energy-level alignment at pn-heterointerface



Drastic increase-decrease in drain current



Left: Device configuration, Middle: drain current (I_D)-gate voltage (V_G) curves of respective transistors. Right: Input-output curve showing three-level inverter (1, 1/2, 0)

Publications

- K. Kobashi, R. Hayakawa, T. Chikyow, Y. Wakayama, Nano Letters DOI: 10.1021/acs.nanolett.8b01357
- K. Kobashi, R. Hayakawa, T. Chikyow, Y. Wakayama, J. Phys. Chem. 122, 6943-6946 (2018)
- K. Kobashi, R. Hayakawa, T. Chikyow, Y. Wakayama, ACS Appl. Mater. Interfaces 10, 2762-2767 (2018)
- K. Kobashi, R. Hayakawa, T. Chikyow, Y. Wakayama, Advanced Electronic Materials 3 1700106_1-6 (2017)

Summary

- Drastic increase-decrease in I_D was controlled.
- Novel transistor mechanism was proposed.
- Multivalued inverter was developed.

Research outcome

- Materials optimization to reduce driving voltage
- Further increase in multi-values.
- Application to flexible substrate