

Reconfigurable Nano-spin Devices

Masaaki Tanaka

(The University of Tokyo, Department of Electronic Engineering, Professor)

【Outline of survey】

We are aiming at the development of basic technologies for reconfigurable nano-scale spin devices that cannot be realized by the conventional semiconductor device technology. We propose new semiconductor-based device structures with spin-degrees of freedom, and fabricate the reconfigurable devices (in which the device functions can be reprogrammed after fabricating the devices), and demonstrate the device operation principles. We plan to study the following three types of spin devices.

- (1) Group-IV-semiconductor based MOSFET planer-type spin devices
- (2) III-V-semiconductor based heterojunction spin devices
- (3) Single-electron type spin transistors based on hybrid materials consisting of ferromagnetic nano-particles and semiconductors.

【Expected results】

- We establish the concept of new semiconductor-based spin transistors and develop experimental studies.
- We apply spin-dependent transport phenomena to three terminal devices with spin-dependent variable output functions, and realize the device functions.
- We develop materials, spin-transport physics, and device fabrication technologies thoroughly for reconfigurable logic applications, and form technological fundamentals.
- We study unexplored academic areas including group-IV (such as Si and Ge)-based spin-functional materials and their spin-dependent transport properties.

【References by the principal researcher】

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- T. Matsuno, S. Sugahara and M. Tanaka, "Novel Reconfigurable Logic Gates Using Spin Metal-Oxide- Semiconductor Field-Effect Transistors", Jpn. J. Appl. Phys. **43**, pp.6032-6037 (2004).

【Term of project】 FY2006 - 2010

【Budget allocation】 17,800,000 yen

【Homepage address】 <http://www.cryst.t.u-tokyo.ac.jp/%7Emasaaki/content.english.html>