Fiscal Year 2012, Tokyo Institute of Technology ASPIRE League Research Grant

Selected Research Projects in FY2012

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	Position	Associate Professor
Co-researchers	HKUST	－
	KAIST	－
	NTU	Wen Siang Lew, Assistant Professor and Principal Investigator Division of Physics and Applied Physics
	Tsinghua	Ce-Wen Nan, Professor and Dean School of Materials Science and Engineering Department of Materials Science and Engineering
Subject of the research project		**Energy Dissipation-Less Spin-Based Devices**
Summary of the research project		Since an electron bears spin as well as charge, the control of electron spin offers exciting opportunities for new functionality and performance in electronics and this spin electronics or 'spintronics' research is currently being studied very extensively. In order to design spin-based functional devices, the primary issues are both to inject electron spins into semiconductor or carbon-based (e.g. graphene) channels and to control the magnetization orientation of a ferromagnetic electrode for the electron spin injection. To date a number of research studies, including ours, have been reported to explore and understand the new physics of spin injection and magnetization control that underpins spintronics technology. Despite such efforts, the principal mechanism of spin injection and magnetization control has yet to be clarified. Furthermore, modern devices must be able to operate at low-energy consumption levels to meet the requirements for environmental impact.

	In this research project, we will explore the mechanisms of spin injection into semiconductor-based quantum wells and graphene structures, as well as the magnetization switching of the ferromagnetic electrode for novel spin devices that can be operative at low-energy consumption levels in a controlled way. Results obtained thus far provide a promising basis for designing spin devices such as spin field-effect transistors. An important goal for this proposal will also be not only to reveal the significant scientific potential of spintronic devices allowing for the continued success of electronics to surpass physical fundamental limits and increasing circuit performance by reducing device dimensions, but also to aim at the establishment of world-leading spintronics research activity in the Asia region. This means contributing to the pool of trained, talented young researchers through researcher exchanges. We hope to achieve this goal through constructive scientific collaboration between Tsinghua University, Nanyang Technological University, and Tokyo Institute of Technology, as these institutions of higher education provide highly complementary expertise and research infrastructure upon which to base the development of spin injection and magnetization control research for spintronic devices.