

Investigating R&D Committee on Highly functional Magnetic Device Technology Based on Optical–Thermal–Electrical Interactions

Technical Committee on Magnetics

1. Objective

The use of magnetic phenomena has enhanced the development of applications for large-scale information use and functional device technology. Since the development of photothermomagnetic recording technology in the 1980s, the Committee on Magnetics Technology has conducted technical surveys and supported research and development. This has enhanced the development of information storage technology related to magnetism and light, such as thermal and microwave-assisted magnetic recording and holographic magnetic recording, and the development of high-function devices and sensors based on optical–thermal–magnetic interactions. These are expected to achieve a crucial status in the support of big data generation and social packaging of IoT technology as well as future magnetic application technologies, e.g., large-scale, high-speed information processing technology and versatile physical quantity sensing technology. Therefore, this committee proposes the establishment of an "Investigation Committee on High-Function Magnetic Device Technology Based on Optical–Thermal–Electrical Interactions," for studying and investigating new highly functional magnetic devices based on optical–thermal–electrical interactions.

2. Background and internal and external research activities

The understanding, control, and use of various spin-dependent phenomena for light, heat, and electricity presented by solids are the core of next-generation spin devices using spin flow and spin waves. The use of electrical–magnetic and optical–thermal interactions supports recent developments in the spintronics field and is defining the role and importance of magnets. Against this backdrop, developments have been sought in existing device principles, new spin-dependent phenomenon exceeding evaluation indices, material searches, and fabrication and evaluation technology, to achieve high integration and power consumption through nanoscale miniaturization and acceleration toward THz band operation. These physical phenomena and new technologies have been the subject of the latest research reported at international conferences, e.g., IEEE Intermag Conference, Magnetics and Optics Research International Symposium, and international symposiums. It appears that researching and collecting the latest information from these various research presentations, comprehensively understanding optical–thermal–electrical and magnetic interactions, and the technology to evaluate and apply them would be important for device development in future.

3. Investigative matters

- 1) Investigate technology in the field of fusing optical–electrical coupling systems, e.g., plasmons with magnetism
- 2) Investigate techniques of evaluating magnetic high-speed phenomenon and high-speed response properties with ultra-short pulse light
- 3) Investigate technology in the field of magnetic storage based on light, heat, and electricity
- 4) Investigate technology related to new spin devices using spin waves and spin current
- 5) Investigate technology related to information-processing devices and sensors based on magnetism

4. Expected effects

- 1) Ascertain high-function magnetic device technology based on optical–thermal–electrical interactions
- 2) Ascertain the physics of optical–thermal–electrical interactions and fields of applying magnetism such as storage
- 3) Ascertain spin devices using spin information of electrons
- 4) Propose new highly functional magnetic devices using light, heat, and electricity
- 5) Clarify issues in developing magneto-optical devices, magnetic recording, solid-state magnetic memory,

sensors, and optical communication devices, joining next-generation considerations of magnetism, light, heat, and semiconductors.

5. Term of investigation

April 2020 to March 2023 (3 years)

6. Committee members

Position	Name	Affiliation	Member/Non-member category of IEEJ
Chairperson	Arata Tsukamoto	Nihon University	Member
Member	Hiroyuki Awano	Toyota Technological Institute	Member
"	Takayuki Ishibashi	Nagaoka University of Technology	Member
"	Kenichi Uchida	National Institute for Materials Science	Non-member
"	Shinichiro Onuki	Nihon University	Member
"	Wataru Odajima	Fujitsu, Ltd.	Member
"	Takeshi Kato	Nagoya University	Member
"	Akira Kikitsu	Toshiba Corporation	Member
"	Nobuaki Kikuchi	Tohoku University	Member
"	Takuya Sato	Tokyo Institute of Technology	Member
"	Hirofumi Suto	National Institute for Materials Science	Non-member
"	Koji Sekiguchi	Yokohama National University	Member
"	Yuji Takatsuka	Sumitomo Metal Mining Co., Ltd.	Member
"	Yukiko Takahashi	National Institute for Materials Science	Non-member
"	Shingo Tamaru	National Institute of Advanced Industrial Science and Technology	Non-member
"	Katsuji Nakagawa	Nihon University	Member
"	Shigeki Nakagawa	Tokyo Institute of Technology	Member
"	Masakazu Hirata	Seiko Holdings Corporation	Non-member
"	Motoyoshi Murakami	Pasona Knowledge Partner Inc.	Non-member
Secretary	Yuichi Nakamura	Toyohashi University of Technology	Member
Assistant secretary	Yoshito Ashizawa	Nihon University	Member

7. Activity schedule

Committee meetings: 4 times/year; Secretariat: 2 times/year;

Cooperation for Magnetics Technical Meetings: 2 times/year

8. Reporting format

The results of investigations based on this committee will be reported in a symposium at IEEJ National Meeting or a themed session at Annual Conference of Society A.

Reason:

The main objective of this committee is to investigate technologies related to highly functional devices by actively using the interaction of physical quantities of light, heat, and electricity, using magnetism as an intermediary. This field is characterized by the presence of several non-IEEJ academic and commercial researchers active in the JPS and JSAP owing to their background in the development of basic fields. Therefore, reports will be presented in a symposium at IEEJ National Meeting, or a themed session at Annual Conference of Society A, which by combining invited lectures and general submission requests, will contribute to Society A by increasing the number of participants and opportunities to interact with the society members, and inviting others to join and become active members.