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Editorial

Special Issue "Terahertz (THz) Science in Advanced Materials, Devices and Systems"

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Terahertz (THz), a specific frequency region of electromagnetic wave laying between 0.3 and 30 THz, has attracted many researchers since the coherent generation and detection of THz were first demonstrated by D.H. Autson et al. [1]. Because of the lack of stable and compact THz sources and emitters, this frequency region has been recognized as a gap in the electromagnetic wave. Over the past two decades, rapid progress in terahertz science and technology has enabled us to apply this attracting electromagnetic wave to various advanced applications, including for use in materials, devices, and systems [2].

In this Special Issue, we highlighted recent advances in THz devices, THz functional materials, and THz application systems with the following keywords:

- Terahertz chemistry;
- Terahertz biology;
- Terahertz medical applications;
- Terahertz functional nano-materials;
- Terahertz spectroscopy;
- Terahertz microscopy;
- Terahertz sources and detectors;
- Application in industry;
- High-field terahertz and nonlinear terahertz optics.

Regarding applications in communication, M. Ghazialsharif et al. gave a good review of broadband transmission using metal wires in the THz frequency, which promises high-speed signal processors [3]. Non-metallic waveguides are also good candidates for practical components of THz communication. R. Koala et al. achieved ultra-low-loss and broadband transmission of THz wave using all-silicon dielectric waveguides [4]. Moreover, a numerical simulation of a symmetric dielectric waveguide with graphene plates was presented by D.A. Evseev et al. [5]. The techniques shown in these articles may be a milestone in developing novel functionalized passive and active THz components. Wireless communication with a 30 Gbps data rate at 245 GHz was demonstrated mainly by commercial equipment [6], which implies that the THz communication link is almost ready for the market.

Studies in THz detectors and sources, including THz parametric generator [7], optical rectification [8,9], difference frequency generation [10], and metamaterial structures for THz detectors [11], are still active research fields. This progress in detectors and sources enables us to realize real-time THz spectroscopy and practical non-destructive tests.

Evaluation of dynamic properties of photocarriers using THz technologies is an exciting topic that opens the door for new applications of material science [12,13]. Additionally, applications of highly sensitive measurements of biological and medical samples are rapidly increasing [14].

Some of the recent remarkable milestones in security and industrial application include the walkthrough body scanner presented by T. Ikari et al. [15] and distance measurements demonstrated by M. Honjo et al. [16].

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In summary, THz science has made significant progress in recent years and is still at the frontier of science. We hope that this Special Issue contributes to showing the current stage of THz and encourages young researchers in this exciting field.

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