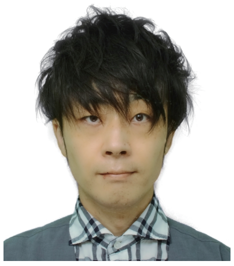
9th Special Issue on the Workshop on Next-generation Front-edge Optical Science Research and JSAP Frontier Research Group of Extreme Excitation and Quantum Energy Conversion

Preface



Ionizing radiation detection and measurement techniques play an important role for many years and provide a wide range of benefits to our daily life. Notable examples include nuclear and particle physics research, medical imaging, radiotherapy, diffraction experiments, nondestructive testing, homeland security, and well logging. The continuous development of applications has stimulated a large demand for an increased understanding of the fundamental properties of luminescence materials and the development of novel materials with superior performance. Luminescence materials for ionizing radiation detectors are roughly classified into two types: scintillators and storage phosphors. Scintillators are materials with the function of detecting ionizing radiation and instantaneously converting it to low-energy photons, commonly known as UV–visible light, via electromagnetic interactions. The emitted light is generally recorded as an electrical signal with a photosensitive detector such as a photomultiplier tube (PMT) or Si-based photodiode. Storage phosphors can accumulate the energy of ionizing radiation in the form of trapped carriers over several weeks. There are at least three types of storage phosphors: thermoluminescence (TL), optically stimulated luminescence (OSL), and radio-photoluminescence (RPL) dosimeter materials. The irradiation dose can be measured from the TL, OSL, or RPL intensity, which is proportional to the concentration of trapped carriers. In this special issue, we focus on the use of such luminescence materials based on various forms, from single crystals to transparent ceramics, nanoparticles, and amorphous materials, for ionizing radiation detector, monitoring, and imaging system.

The Workshop on Next-generation Front-edge Optical Science Research and JSAP Frontier Research Group of Extreme Excitation and Quantum Energy Conversion demonstrate recent achievements in this field from the viewpoints of phosphor material physics and chemistry for ionizing radiation detectors and sensing applications. The first seven special issues were published in 2015 (seven papers, Vol. 27, No. 3), 2016 (12 papers, Vol. 28, No. 8), 2017 (11 papers, Vol. 29, No. 10), 2018 (12 papers, Vol. 30, No. 7), 2019 (10 papers, Vol. 31, No. 4), 2020 [14 papers, Vol. 32, No. 4(2)], 2021 [17 papers, Vol. 33, No. 6(4)], and 2022 [22 papers, Vol. 34, No. 2(2)]. For this 9th special issue, 16 papers have been accepted pending mandatory changes and final examination by the guest editor. This special issue presents the recent development of novel materials for ionizing radiation detection and measurement, especially in academic research.

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