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Editorial

Modifications of Metallic and Inorganic Materials by Using Ion/Electron Beams

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Welcome to the Special Issue of *Quantum Beam Science* entitled "Modifications of Metallic and Inorganic Materials by Using Ion/Electron Beams". This Special Issue has collected original and review papers using energetic ion/electron beams in basic and applied research for new and novel metallic and inorganic materials' modifications. When materials are irradiated with energetic particles (ions or electrons), their energies are transferred to electrons and atoms in materials, and the lattice structures of the materials are largely changed to metastable or non-thermal-equilibrium states, causing modifications of several physical properties. Such phenomena will engage the interest of researchers as a basic science and can also be used as promising tools for adding new functionalities to existing materials and developing novel materials. Compared with organic materials such as polymers, however, not many studies on the modifications of metallic or inorganic materials by electron or ion irradiations have been performed so far.

The present Special issue of *Quantum Beam Science*, therefore, focuses on experimental investigations and computer simulations related to the modification of lattice structures and various physical properties (mechanical, electronic, magnetic, optical, and so on) of metallic and inorganic materials. The developments of accelerators and ion or electron beam equipment for the materials' modification are also included in the scope of this Special Issue.

The original and review articles of this Special issue cover the electron/ion beam induced modifications of optical properties of oxides, such as colors [1] and refractive indices [2]; the electronic properties of solar cells [3] and superconductors [4,5]; the mechanical property (hardness) of metallic alloys [6]; and chemical properties, such as the catalyst function of a metal surface [7], the corrosion of a metallic alloy [8], and the hydrogen desorption and retention of a metallic alloy [9]. In addition, several articles show ion/electron-beam-induced modifications of crystal structures, such as the lattice disordering of non-metallic materials [10], the phase transformation of an oxide [11], the hillock and ion-track formation in ceramics [12], the formation of nanostructured materials in oxides [13] and the generation of self-organized nanostructures on the surfaces of pure metals [14]. One of the review papers reports the details of the swift heavy-ion irradiation effects in CeO_2 with many references [15]. Moreover, the ion-beam-induced modifications of lattice structures and/or magnetic properties in oxides are discussed by using computer simulations (Monte Carlo method [16] and molecular dynamics [17]). As for the facility and the equipment used for the study of electron or ion beam irradiation effects, the ion accelerators at the Wakasa Wan Energy Research Center for the study of irradiation effects on space electronics [18] and the pulsed transmission microscope for high-speed observation and material nanofabrication [19] are introduced.

The original and review articles reported here include a lot of interesting results. I hope many readers will enjoy this Special Issue.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

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Citation: Iwase, A. Modifications of Metallic and Inorganic Materials by Using Ion/Electron Beams. *Quantum Beam Sci.* **2022**, *6*, 1. https://doi.org/10.3390/qubs6010001

Received: 22 December 2021
Accepted: 27 December 2021
Published: 29 December 2021

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