

Preface

Ionizing radiations have played extremely important roles in the early development of quantum mechanics and chemistry. Without the discovery and subsequent development of the science of radiations, the principal aspects of the structure of atoms and molecules could not have been established. For more than a century since humans first realized the use of atomic energy, many greatly beneficial applications of radiations have emerged. The landscape of the development of material science, energy sources, or even medical devices has increasingly relied on radiations. Such widespread uses inevitably demand better understanding of the effects of radiations. For instance, in the event of nuclear disasters and radioactive incidents, the fear of the effects of ionizing radiation on the human body and the organic media could be overwhelming. A comprehensive and quantitative understanding of the radiation chemical processes is the key element not only to overcome such fear but also to keep the effects in a beneficial regime such as is used in cancer radiotherapy, for instance.

Throughout the history of quantum mechanics, ionizing radiation has always been at the center of the experiments to understand the nature of electromagnetic waves, electrons, and atoms. Since the discovery of ionizing radiations by Roentgen, observations of the “interactions” with matter have provided numerous breakthroughs in the field of physics and chemistry and oftentimes even in medical science. By calling the radiations “X-rays”, “ α -rays”, “ β -rays”, “ γ -rays”, etc. by their plural forms, we imply the transmitting and invisible natures of radiations, rendering them too difficult to count, visualize, and distinguish by each “ray”. Only until recently, due to the new technological advancements from the last century, the damages to materials caused by a single “ray” have never been utilized as a platform for radiation detection, let alone as a technique for carving nanostructures out of materials through subsequent chemical etching. Herein, this book introduces the challenges to materials fabrication by a “single ray”, once thought to be absurd, starting from the basic concept of interactions of a “single ray” with matter to the requirements for the materials and the ray in order to realize the fabrication. This book also guides potential readers from the theory to the reality of the concept: “materials nanofabrication by a particle”, and hence the changing paradigm from “ionizing radiations as a source of material damages” to “ionizing radiations as a versatile tool for materials fabrication”.

High-Energy Charged Particles
Their Chemistry and Use as Versatile Tools for
Nanofabrication

Seki, S.; Sakurai, T.; Omichi, M.; Saeki, A.; Sakamaki, D.
2015, X, 74 p. 44 illus., 41 illus. in color., Softcover
ISBN: 978-4-431-55683-1