# Preface

Spallation material technology is a common knowledge for the concept of nuclear transmutation by accelerator drive, and the source of neutron scattering experimental facilities including muon source. The concept of nuclear transmutation by accelerator drive aims at converting minor actinides such as long-lived nucleons contained in spent nuclear fuel into short-lived ones, by reducing the toxicity contained. It is a technique that aims at easier management for spent fuel.

Spallation reaction is an event related to the in-substance transport of high-energy particles. When an energetic proton collides with nucleons, i.e., neutrons and protons inside the nucleus, an intra nuclear cascade reaction occurs, consisting of the emission of high energy particles, including energetic secondary particles (proton, neutron, pion and so on). These secondary. particles can collide with other nuclei (internuclear cascade). The charged particles emitted from the nuclei, together with incident protons, interact with electrons of atoms and give up part of their energy, resulting in a temperature increase. There is a lot of release of light nuclear gas as compared to the fission reaction. It stays in the material and affects its thermal mechanical characteristics.

Neutron flux of the reactor becomes saturation. The accelerator-driven neutron source facility supplies a neutron flux exceeding the limits of the reactor, and It has attracted attention from the viewpoint of nuclear non-proliferation, the sophistication and new facilities of the facilities worldwide. Changes in the thermal load properties of materials occur due to the incident of accelerator-driven high-energy protons into the target and the material surrounding them. There are two solid and liquid state in the target. The former damage of the material becomes an issue. The latter is unrelated to the damage phenomenon. Due to increased pressure by nuclear heat generation, however, compatibility between the liquid metal and the structural material and flow control becomes engineering matter. In material research using inductive methods generally, post-irradiation examination and laboratory tests are the only ways to learn about property changes, and material data has been accumulated so far. Moreover, the feature of the post-irradiation examination, inclusive irradiation, cooling, and mechanical test and microscopy takes a long time to get data. Even in the flow test of liquid metals, it is important to know a change over time.

The authors of this book have extensive knowledge based on their experience in neutron source development at their respective facilities and include the following topics: Heavy liquid metal target and coolant, Proton and neutron irradiation, Solid targets, Charged particles irradiation and positron annihilation and Construction and termination.

It will be a reference for researchers and engineers who intend to participate now and in the future.