Perface

The aim of this monograph is to introduce positron surface physics as a new tool for surface science. The researches for positron-surface interactions and related phenomena began mainly after the discovery of monoenergetic positron beam lines by A.P.Mills,Jr. in AT&T Bell Laboratories in the late 70's. The first decade after the discovery, most of all investigations were done in order to develop positron beam lines of better intensities and better monochromaticities. In contrast with positron source used in the conventional positron physics, the above monoenergetic positron beam is called *slow positron*, because conventional positron source emits positron of a few MeV.

On the other hand, many positron researchers at that time had a lot of experience on bulk material research using positron; especially on Fermi surface measurements and defect profile. Therefore, application of the new positron beam began first in such subjects. The monochromaticity of positron beam have been usually used to control the implantation depth of injected positron in solid.

Nowadays, the editor thinks that the technologies for sophisticated positron beam line has been well established, though we still expect more intense, more monochromatic, shorter pulse beams. Moreover, such positron beam lines begin to be popular in the world; U.S has three intense beams, Japan has two, Europe has two, and many more intense beams are in planning or under construction. Non-intense monochromatic beam lines ($\sim 10^4 e^+/s$) are now very popular and industrial laboratories begin to have them. Therefore, applications of positron should not be bounded to bulk and subsurface researches. This new beam would have a lot of possibility in surface science as a new probe.

Fortunately, there are some researches related to surface, though it would not be so sophisticated as electronic spectroscopies. This monograph is mainly consisted with those studies, which are based on strong frontier spirits. The readers can find what is the frontier of positron-surface physics at the moment. Many authors of the articles have contributed significantly to slow-positron beam physics in the last decade.

On the other hand, the editor try to gather *non-positron physisists* whose subjects are very close to positron physics, because I would like to extend the positron surface physics groups as much as possible. Thus, this monogroph is a fusion of the above two kinds of people.

Surface sciences have continued drastic developments in the last decade, because we can observe and control atomic structures of surfaces at least partially with Scanning Tunneling Microscopy, Atomic Force Microscopy, Molecular Beam Epitaxy and a lot of other spectroscopies using electron or photon beams. Since one of the dominant purpose of surface science is to observe *surface* itself without distortion from its substrate, positron will play important

role as a surface-sensitive probe in near future.

After the introduction, foundamental aspects of positron-surface interaction are discussed theoretically in **2.Positron-Surface Interaction**. In **3.Positron-Surface Scattering**, elastic and inelastic positron-surface scattering or collision are discussed. Some subjucts would be familiar for surface science people. In **4.Positronium Formation**, theoretical aspects of positronium formation at surface are presented. The experimental aspects of positronium formation can be found in section 3. The **positron surface states** are discussed experimentally and theortically in section 5. In **6.New Topics**, several new trials and developments in this field are introduced. These topics are significant not only at the aspect of scientific but also at the aspect of technology.

Finally, the editor is grateful to all authors who present excellent contributions though they all have been very busy for the current researches.

The editor
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