

# Recent Developments of the Slow Positron Facility

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In 2010, the convertor/moderator assembly for the generation of the slow positron beam has been replaced. The converter and the frame for the moderator is made of Ta. The moderator is made of  $25\text{ }\mu\text{m}$  thick W foil strips. The strips are formed into two sets of rectangular lattices. The lattice moderators are electrically isolated from each other and from the converter. A high voltage source supplies up to 35 kV to the converter. It also supplies cascading floating voltages, 0-10 V each, to the moderators and the extracting grid. The slow positrons are extracted into the direction perpendicular to the linac beam, out of the lattice face.

The annealing of the moderators were made after the W strips were set up into the rectangular lattices. They were encased in a covered box of  $50\text{ }\mu\text{m}$  thick W foil, and the box were irradiated with the beam of an electron beam welder. The temperature was elevated to around  $2400\text{ }^{\circ}\text{C}$ , considerably higher than common practice for W positron moderators. The vacuum of the chamber was  $1 \times 10^{-5}$  Torr.

The intensity of the slow positron beam before and after the replacement of the assembly was compared by measuring the annihilation  $\gamma$ -rays from a Micro Channel Plate (MCP) beam monitor. It was found that the beam intensity was increased an order of magnitude to  $7 \times 10^7$  slow positron/s.

A progress in experiments on the positronium negative ion ( $\text{Ps}^-$ ) has been made by Nagashima Group of Tokyo University of Science. A high fraction (1%) of  $\text{Ps}^-$  is obtained from alkali metal coated W, and photo-detachment of the ion was performed by using the short pulse positron beam and an intense photon beam from a Q-switched ND:YAG laser[1]. Next, time of flight measurements on the neutral Ps atom created through the photo-detachment successfully confirmed that energy-tuned Ps beam can be made by accelerating  $\text{Ps}^-$  followed by photo-detachment.

A station for the reflection high energy positron diffraction (RHEPD) has been constructed on a beam line branch. This is a project of Dr. Fukaya (Kawasuso Group) of the Japan Atomic Energy Agency. The RHEPD is a positron version of the reflection high energy electron diffraction (RHEED). Kawasuso and Okada[2, 3] brought this method into practical use. This method is very sensitive to the topmost layer of atoms of the surface and it is possible to observe the lowest index diffraction spots. Measurements have already started.

[1] K. Michishio, et al., *Phy. Rev. Lett.*, **106**, 153401 (2011) and references therein.

[2] A. Kawasuso and S. Okada, *Phys. Rev. Lett.*, **81**, 2695 (1998).

[3] Y. Fukaya, et al., *Phys. Rev. B* **79**, 193310 (2009) and references therein.