Current status of the AIST slow positron beam facility

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At the AIST slow positron beam facility, research and development of positron beam control and/or measuring devices have been continuously conducted in order to carry out advanced material research.

The facility uses both an electron accelerator (LINAC) and a Na-22 radioisotope (RI) as positron sources for the same beamline. In the LINAC based positron source, a 40 MeV electron beam is injected into a tantalum converter to generate fast positrons, which are moderated through tungsten foils to obtain a slow beam. In the RI based source, fast positrons from the RI are moderated through a thin layer of solid Ne to obtain a slow beam. Normally, the higher-intensity LINAC based source is used for various experiments, but the RI-based beam can be easily used during LINAC maintenance periods and for simple adjustment experiments. Then, by using both types of positron sources interchangeably, our research and development can proceed efficiently.

The beamline is branched into four lines, which are connected to a positron lifetime measurement system (PALS), a positron probe microanalyzer (PPMA), a coincidence Doppler broadening measurement system, and a buffer-gas type positron accumulator respectively. PALS is used for lifetime measurements of relatively larger samples including liquids [1] using a high intensity beam (~10 mm diameter) while PPMA is used for lifetime measurements for relatively smaller samples [2] using a focused beam (~0.1 mm diameter). The positron accumulator is being developed to obtain high quality beams [3]. In particular, the positron beam extracted from the LNAC based source has a relatively large energy spread of a few eV and diameter ~10 mm. We would like to cool the positrons, compress them radially with a rotating electric field in the accumulator and extract them into high-quality beams for future experiments.

The facility is open to external users through the "Nanotechnology Platform" project in Japan [4] and is used for approximately 10 material research projects annually.

[1] T. Hirade, K. Michishio, Y. Kobayashi, N. Oshima, *Acta Physica Polonica A* 137, 109 (2020).
[2] K. Sato, N. Oshima, *Rev. Sci. Instru.* 91, 083907 (2020).
[3] H. Higaki, K. Michishio, K. Hashidate, A. Ishida, N. Oshima, *Appl. Phys. Express*. 13, 066003 (2020).
[4] https://unit.aist.go.jp/rima/nanotech/ancf-index-en_2020fy.html