

## Poster Presentation

MS111.P03

### *A total reflection high-energy positron diffraction station at the KEK-SPF*

K. Wada<sup>1</sup>, M. Maekawa<sup>2</sup>, Y. Fukaya<sup>2</sup>, I. Mochizuki<sup>1</sup>, T. Hyodo<sup>1</sup>, T. Shidara<sup>1</sup>, A. Kawasuso<sup>2</sup>

<sup>1</sup>High Energy Accelerator Research Organization (KEK), Ibaraki, Japan, <sup>2</sup>Japan Atomic Energy Agency, Takasaki, Japan

A high-intensity mono-energetic positron beam generated by using a linear electron accelerator (linac) provides total reflection high-energy positron diffraction (TRHEPD) researches at Slow Positron Facility (SPF), KEK [1,2]. A pulsed 50-Hz electron beam generated with a dedicated linac (operated at 55 MeV, 0.6 kW) is injected on a Ta converter and causes fast positron-electron pair creation through bremsstrahlung. The positrons showering down on 25  $\mu\text{m}$ -thick W foils, are moderated to thermal energy, and a fraction spontaneously comes out of the foils with an energy of 3 eV owing to the negative work function. The positron converter/moderator assembly is held at an electrostatic voltage of 15 kV for TRHEPD experiment. The emitted positrons are consequently accelerated to 15 keV as they enter the grounded beam-line and are guided by the magnetic field of about 0.015 T to the TRHEPD station. For diffraction experiments, positrons transported by the magnetic field have to be first released into a nonmagnetic region. Since the released positron beam has a large diameter, a brightness-enhancement unit is effectively used to achieve a small-diameter and highly-parallel beam with a sufficient flux. The linac-based positron beam gives about 60 times intensified diffraction pattern from a Si(111)-7 $\times$ 7 reconstructed surface compared to a previous result with a Na-22-based positron beam [3]. An improved signal-to-noise ratio in the obtained pattern due to the intensified beam allowed an observation of clear fractional-order spots in the higher Laue-zones, which had not been observed previously. The much intensified beam with the present system allows adjustment of the sample orientation without accumulating the positron signals. With the brightness enhanced beam, several remarkable results have been obtained efficiently by users of this facility. (Everybody is invited to use KEK Slow Positron Facility through approval of his/her research proposal.)

[1] K. Wada, T. Hyodo, A. Yagishita, et al., *Eur. Phys. J. D*, 2012, 66, 37-1-4, [2] M. Maekawa, Y. Fukaya, A. Kawasuso, et al., *Eur. Phys. J. D*, to be published, [3] A. Kawasuso, T. Ishimoto, M. Maekawa, et al., *Rev. Sci. Instrum.* 2004, 75, 4585-4588

**Keywords:** Total reflection high-energy positron diffraction, Slow-positron beam, Surface structure