Slow positron beam with digital Doppler broadening spectrometer and in-situ film deposition by electron evaporation

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A compact magnetically guided continuous variable energy slow positron beam was built at the Charles University, Prague. A ^{22}Na radioisotope with activity of 1.85 GBq (iThemba LABS) is used as a source of fast positrons. Transmission geometry positron moderator consists of a W foil with thickness of 9 μm attached directly to Ti window of the ^{22}Na capsule and followed by a set of four W meshes kept at negative potential gradually decreasing from 0 down to -12 V. Slow positrons are separated by bending of the beam in the magnetic field. Moderated slow positrons can be accelerated up to 30 keV using an electrostatic accelerator. The beam is designed for defect studies of thin films. It is equipped with a chamber for in-situ preparation of films by two electron evaporators (Tectra). Films prepared in the deposition chamber can be transferred to the sample chamber for positron annihilation measurement and back without breaking of vacuum. It enables step-by-step characterization of thin films during growth. Doppler broadening of annihilation photopeak is measured using two high purity Ge detectors with energy resolution of 1.2 keV at 511 keV. Detectors are located in face-to-face geometry perpendicular to the positron beam and can work either independently or in coincidence. Detector signals are worked out using a digital setup [1].

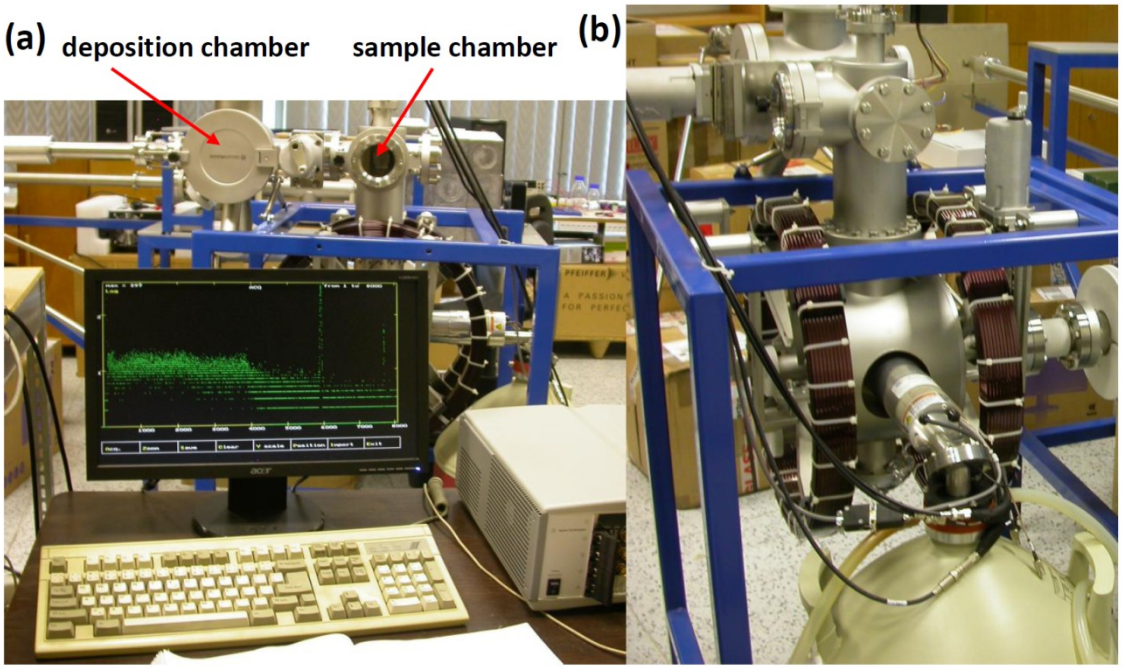

Figure 1 *(a) A front view of the slow positron beam, (b) detail of the sample chamber.*

References

[1] J. Čížek, M. Vlček, I. Procházka, *Nucl. Intr. Meth. A.* **623**, 982-994 (2010).

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