

The pulsed low energy positron system PLEPS: applications and new developments

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The pulsed low energy positron system PLEPS [1] is a user facility for defect depth-profiling with positron lifetime measurements using a monochromatic pulsed beam of variable implantation energy at the intense positron source NEPOMUC at the MLZ in Garching, Germany [2].

At present it is possible to measure with PLEPS positron lifetime spectra in the energy range between 0.5 keV and 20 keV with acquisition-rates between 10000-20000 counts per second, depending on the sample. It takes typically a few minutes to measure a lifetime spectrum with 4×10^6 counts at a single energy. A full depth-profile with 10-15 energies requires about 1-2 hours. Depending on the detector, an overall time-resolution of 180 ps-240 ps and peak-to-background ratios of up to 1.5×10^5 can now be routinely achieved within a time-window of 40 ns [3]. For precise measurements of long lifetimes (> 5 ns) it is now possible to extend the time window to 160 ns at an overall time resolution of 300 ps. The sample temperature can be varied between 80 K and 600 K.

Typical applications of PLEPS comprise the defect identification in thin layers and layered structures of semiconductors [4,5] and insulators [6], the investigation of irradiation induced defects in materials for fusion and fission, as well as the characterization of open volumes in glasses [7], polymers, polymer- and membrane layers [8]. In this talk we will describe the present setup of PLEPS and its performance, show some exemplary applications and give an outlook of future developments.

References

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