



SPM: Scanning positron microscope

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Abstract: The Munich scanning positron microscope, operated by the Universität der Bundeswehr München and the Technische Universität München, located at NEPOMUC, permits positron lifetime measurements with a lateral resolution in the μm range and within an energy range of 1 – 20 keV.

1 Introduction

The scanning positron microscope (SPM) enables the measurement of high resolved 3D defect maps. Until today, the SPM was operated only in the laboratory at the Universität der Bundeswehr in Munich and was therefore limited by the long measurement times of several days per 2D-scan due to the low intensity of the positron beam produced by a standard ^{22}Na source. This disadvantage will be overcome by installing the SPM at the high intensity positron beam at NEPOMUC.

Therefore, the SPM interface was designed and tested successfully (Piochacz et al., 2007). This device converts the continuous beam of NEPOMUC to a high-brightness, pulsed positron beam, which matches the demands of the SPM. Recently, a sample chamber was connected to the SPM interface which enables spatially resolved positron lifetime measurements with a lateral resolution in the range of 0.1 mm.





Figure 1: Instrument SPM at NEPOMUC (Copyright by W. Schürmann, TUM).

2 Technical Data

2.1 Beam properties SPM / SPM Interface

- Positron implantation energy: $< 20 \text{ keV}$ / $< 10 \text{ keV}$
- Beam-Spot $< 1 \mu\text{m}$ / $\approx 0.1 \text{ mm}$
- Count rate: $> 2000 \text{ cps}$ / $> 4000 \text{ cps}$
- Time-Window: 20 ns
- Time-Resolution: $< 250 \text{ ps}$
- Peak/ Background: $> 5000 : 1$ / $> 2000 : 1$

2.2 Typical measurement times

- SPM: $\approx 1 \text{ day}$ for one 2D-Scan ($12 \times 12 \mu\text{m}^2$)
- SPM interface: $\approx 0.5 \text{ day}$ for one 2D-Scan ($1 \times 1 \text{ mm}^2$)

References

Piochacz, C., Egger, W., Hugenschmidt, C., Kögel, G., Schreckenbach, K., Sperr, P., & Dollinger, G. (2007). Implementation of the Munich scanning positron microscope at the positron source NEPOMUC. *Physica status solidi / C*, 4(10), 4028-4031. <http://dx.doi.org/10.1002/pssc.200675824>