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The Coincident Doppler-Broadening Spectrometer at NEPOMUC

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Doppler broadening-spectroscopy (DBS) of the 511keV gamma line, generated by positron-electron-annihilation, provides information on lattice defects, sensitive to concentrations as low as 1e-7 vacancies per atom. In addition the chemical surroundings of defects can be analyzed by coincident DBS (CDBS). The CDB-Spectrometer at the Neutron-induced Positron Source Munich (NEPOMUC) is presented. Ongoing improvement works will be shown.

The maximum probing depth of the positron beam is material dependent and varies from hundreds of nm, for heavy metals, to a few micrometers in, e.g., Si. Two beam modes are available: standard measurements with a $\approx$ 300 μm (FWHM) beam spot and high resolution measurements with a micro beam with a resolution of 33 μm (FWHM). Measurements may either be conducted as DBS, where the signal at each detector is treated separately, or as CDBS, where the detectors are run as coincidence pairs, greatly improving the signal-to-noise ratio. Currently four different sample holders are available: i) a piezo x-y stage for precision 2D scanning and hence 3D defect imaging, ii) a heatable sample holder with $T_{max} = 1100$ K for T dependent defect spectroscopy, iii) a cryostat with $T_{min} = 40$ K and iv) a device for in situ tensile tests.

Ongoing improvements comprise: an automated beam optimization system and an increase in the number of detectors combined with an upgrade of the readout electronics.

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