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^{22}Na -Sample Setup for Single-Specimen Coincidence Doppler Broadening Spectroscopy

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This paper describes the design, construction and testing of a new ^{22}Na isotope based sample-source setup called Single Specimen Positron Annihilation Spectroscopy (SSPAS) for measurements at the Coincidence Doppler Broadening Spectrometer (CDBs) positioned at the NEutron induced POsitrone source MUniCh (NEPOMUC) beam line. Coincidence Doppler Broadening Spectroscopy (CDBS) measurements allow the detection of vacancy like defects due to the intrinsic attraction of positrons to such lattice defects. SSPAS addresses many problems of the previously employed sandwich sample design. SSPAS only requires a single sample and supports a wide range of sample sizes.

The ratio between 1275 keV and 511 keV gammas measured was approximately halved indicating lower background introduced by 1275 keV gammas. Most importantly, measurements showed the absence of the Kapton source component typically tainting Positron Annihilation Spectroscopy (PAS) data gathered with the conventional sandwich method. SSPAS is vacuum capable and CDBS measurement times are in the order of several days. Compared to the sandwich method, SSPAS allows for more accurate and more versatile measurements than previously possible without relying on the positron beam line.

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