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Development of a Positron-Electron Annihilation Spectrometer to Characterize Defects in Crystalline Materials at Union College JACOB E. FEINSTEIN, COLIN M. LANGTON, MIA E. VILLENEUVE, SCOTT M. LABRAKE, MICHAEL F. VINEYARD, HEATHER C. WATSON, Union College — Positron-electron annihilation spectroscopy is an analytical method for characterizing near surface defects on the atomic scale in crystalline samples of materials. Using a thin ^{22}Na source sandwiched between two samples, we will measure the lifetime of the positron and thus be able to characterize the number of defects in a sample from this lifetime. The lifetime of the positron (on the order of 0.4-2.0 nanoseconds) is determined from the time interval between the 1274-keV prompt gamma ray emission from the beta-plus decay of ^{22}Na into an excited state of ^{22}Ne and the subsequent annihilation of the electron and positron in the crystalline sample of interest by detecting the coincident 511-keV gamma rays. In the Union College Ion-Beam Analysis Laboratory (UCIBAL), we are currently constructing a system that will be used to measure the lifetime of the positron. We have successfully built, tested, and detected the coincident 511-keV gamma rays from the annihilation of electrons with positrons from the beta-plus decay of ^{22}Na. Preliminary results will be presented and future modifications to this setup will be discussed which will include the implementation and testing of faster electronics for the timing circuit that will be used to determine the lifetime of the positron.

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