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Positron Annihilation Lifetime Spectroscopy with a ^{68}Ge Positron Source JASON CALLOO, HERBERT JAEGER, Miami University — Positron annihilation lifetime (PAL) spectroscopy is a sensitive technique to probe the electronic environment of positrons in condensed matter. In particular, the lifetime of positrons in condensed matter depends mostly on the local electron density. Often PAL measurements are done with a ^{22}Na positron source because of its wide availability, convenient half life (2.6 y), and modest cost. One disadvantage of ^{22}Na is its low positron energy of E_{max} = 540 keV, which limits penetration of positrons into the material under study. An alternative source of positrons is ^{68}Ge. It decays by electron capture ($T_{1/2}$= 271 d) to ^{68}Ga which in turn decays to ^{68}Zn and emits positrons with energies as high as 1.9 MeV, the highest positron energy of commercially available long-lived radioisotopes. Due to the lack of a prompt gamma emission signaling the begin of the positron′s lifetime, PAL measurements can only performed by detecting the emitted positrons directly. The design of a PAL spectrometer using a ^{68}Ge source will be discussed.

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