

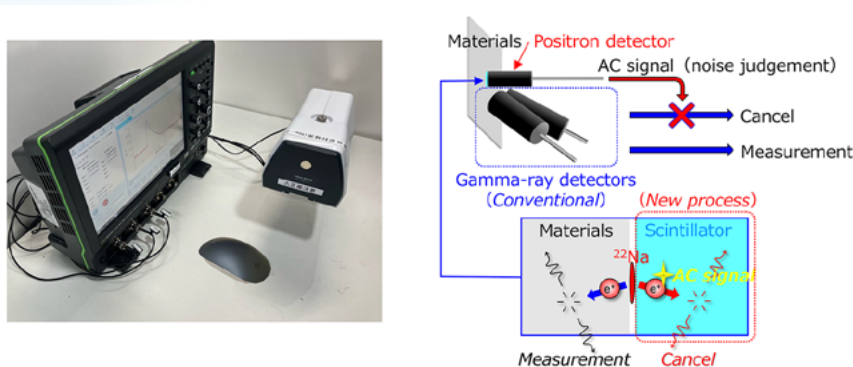
Development of a portable positron annihilation lifetime measurement system

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A positron, the antiparticle of an electron, annihilates with an electron emitting gamma-rays. The positrons are trapped in the intermolecular spaces or lattice defects within the material, and the mean lifetime of the positrons is longer. A positron annihilation lifetime measurement is an analytical method which uses these unique characteristics.

Since material destruction is caused by microscopic damage on the atomic or molecular scale, the positron annihilation lifetime measurement can also estimate the degree of material degradation. Therefore, we developed a portable positron annihilation lifetime measurement system through a joint research project in collaboration with a company (TOYO SEIKO CO., LTD.) and the METI Monozukuri R&D Support Grant Program for SMEs Grant Number JPJ005698. The key technology of this measurement system is the signal-processing "Anti-Coincidence (AC) method," enabling measurement with one sample, instead of two required to sandwich a ^{22}Na positron source. This technology makes it possible to measure without cutting out the sample, thus enabling on-site positron lifetime measurements. We are currently in the process of developing a portable measurement system which uses machine learning and other emerging technologies to inspect infrastructure degradation.

Reference: M. Yamawaki et al., *Jpn. J. Appl. Phys.* **61**, 066503, 2022, <https://doi.org/10.35848/1347-4065/ac65ca>



The portable positron annihilation lifetime measurement system (left), and overview of the Anti-Coincidence method (right).