TUESDAY AFTERNOON, June 21

This paper will concentrate on the later strand and will review past and current developments and offer insights to as yet unforeseen possibilities.

Lunch

13:30 p.m. - 15:30 p.m. Room A
SMS-01: SMART MATERIALS AND STRUCTURES, NDE

SMS-01: Using Photon for Non-destructive Testing of Thick Materials
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We present a non-destructive testing method for thick materials using positrons produced through gamma-conversion. Positron annihilation spectroscopy using positron annihilation lifetimes has been successfully studied for non-destructive material testing. A positron, which is inspection probe, is annihilated with an electron at the front of the material. The application of the positron lifetime method is restricted to thin materials. A photon with energy exceeding 1.02MeV reaches the materials’ depth and can produce a positron through gamma-conversion. Such a photon-produced positron is a probe for thick materials. The probability of gamma-conversion, however, is low. The method of photon-produced positron annihilation lifetimes is restricted by statistics. We estimated the background contributions and the statistical uncertainties for the positron lifetime measurements using an example of monitoring SUS316 stainless steel fatigue. Assuming the detection efficiencies of photons at each photon-counting device to be 50%, it takes approximately 40 minutes to measure the lifetimes within 10% statistical uncertainty, which is sufficient time for long term fatigue monitoring.

SMS-02: Measurement of Thin Film Elasticity Using Nanoscopic Contact Resonance of a Flat Tip in Sensitivity-Enhanced Atomic Force Acoustic Microscopy
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Atomic force acoustic microscopy (AFAM) is a possible technique of measuring elastic modulus of very thin films with a thickness of 10 nm or less. In AFAM, the resonant frequency of a micro-cantilever equipped with a tip measures the contact stiffness between a sample and a tip. Our previous works have introduced a concentrated-mass cantilever and a flat tip for enhancing the sensitivity in the detection of contact stiffness, improving reproducibility of measurements, and simplifying evaluation of elasticity. This study demonstrates characterization of 10-nm-thick diamond-like carbon (DLC) film on a hard disk. The contact area and the elastic modulus of a tip were preliminarily determined by use of well-defined samples such as silicon wafers. The resonant frequency observed for the DLC film under the contact radius of about 1.7 nm was not influenced by the substrate. This successfully led to determining the effective Young’s modulus of 869 ± 50 GPa.

SMS-03: Detection of Inclusion in Steel Sheet with Leaky Surface Acoustic Wave
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This paper developed a method for detection of inclusion in thin steel sheet, using Leaky Surface Acoustic wave (LSAW). A special lens, which has a hollow in its center and is called as DH lens, was developed for improving the conventional LSAW detection. Experiments show that the improved LSAW method with DH lens is effective in detection of the non-metallic inclusions in steel sheet. Comparison is also carried out between the Longitude Wave (LW) detecting method and the improved LSAW method, the result shows LSAW method can detect the inclusion in 20MHz, while the LW method have to use 100MHz for same detec-