In Situ SEY Measurements at CesrTA

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Introduction
Measuring secondary electron yields (SEYs) on technical surfaces in accelerator vacuum systems provides essential information for many accelerator R&D projects, such as the ILC Damping Rings, regarding to electron cloud growth and suppression. As a part of CesrTA research program, we developed and deployed SEY in-situ measurement systems. Two such SEY systems were installed to expose samples with direct and scattered synchrotron radiation (SR), and the SEYs of the samples were measured as a function of SR dosages. In this poster, we describe the in-situ SEY measurement systems and the initial results on bare aluminum (6061-T6) and TiN-coated aluminum samples.

Horizontal In Situ SEY Station in L3 of CesrTA

System Schematic

- Electron gun (inside crotch)
- Magnetic manipulator (electrically insulated from crotch)
- Sample
- Beam pipe

SEY = \( I_p + I_{SET} \)

- Hardware components controlled remotely via LabVIEW software on PC
- Gun energy cycled from 20-1500eV with current \(-2\)A and beam size \(-0.5\)mm
- \( I_p \) is measured with 150V bias before and after \( I_p \) is measured
- \( I_p \) measured with -20V bias

Initial Results – SEY vs. Beam Doses

- TiN-Al Sample
- Al6061-T6 Sample

SEY Peak Beam Processing – TiN-Al

- Data shows a steady (\(-0.05%/\) decrease in SEY peak with increased beam dosage (D) for both types of samples
- \( 45^\circ \) system has a consistently higher SEY than the horizontal system for TiN-coated sample
- Measured SEY peak is dependent on incident angle (left figure)

SEY Peak Beam Processing – Al6061-T6

Control & Data Acquisition System

- Hardware is controlled by LabVIEW GUI developed at Wilson Lab, incorporating existing Kimball Physics Electron Gun and Keithley 6487 Picoammeter software.
- Developed software includes:
  - Synchronizing gun power supply voltages and bias voltages
  - Automating electron beam energy scanning and raster scan subroutine while recording current from ammeter
  - Automating SEY calculation and plotting subroutine

Conclusions & Future Work

- Measured the SEYs from 6061 alloy are much lower than reported values from 6063 alloy. We plan to do comparison using our in-situ systems
- Measure the SEY of a sample cut from an extruded aged (30+ years) 6063 aluminum CESR chamber
- Comparing SEY while suppressing E-cloud with solenoid magnetic field generated.
- Measuring in situ various coated samples (such as NEG thin film, amorphous/diamond-like carbon, etc) provided by collaborators
- Building and testing in situ SEY systems for the FNAL Main Injector

Supported by the National Science Foundation (Contract No. PHY-0734867) and the Department of Energy (Contract No. DE-FC02-08ER41538)