![PHYSICAL ELECTRONICS — A DIVISION OF ULVAC-PHI]

Reflection Electron Energy Loss Spectroscopy UPGRADE for VersaProbe II, III and 4

Reflection Electron Energy Loss Spectroscopy (REELS) is compatible with *VersaProbe* II, *VersaProbe* III, and *VersaProbe* 4. REELS is a surface analysis technique in which a specimen is bombarded with an electron beam (≤ 2000 eV) and the energy distribution of the reflected electrons is measured. This energy distribution contains features corresponding to discrete losses of energy of the reflected electrons due to excited atomic states, valence band transitions, material bandgaps, etc.
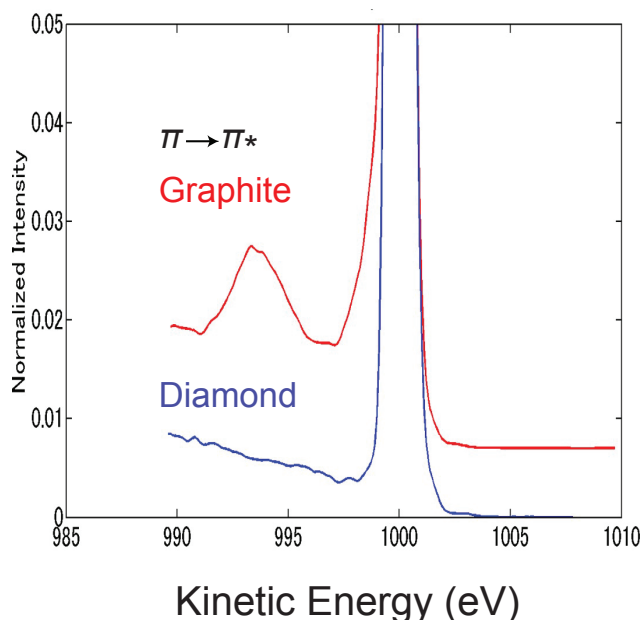
Key Applications of REELS

- Analyze the electronics and bonding states of the materials
- Measure band gap of semiconductors
- Compare the relative concentration of hydrogen
- Discrimination of sp^2 / sp^3 character of carbon
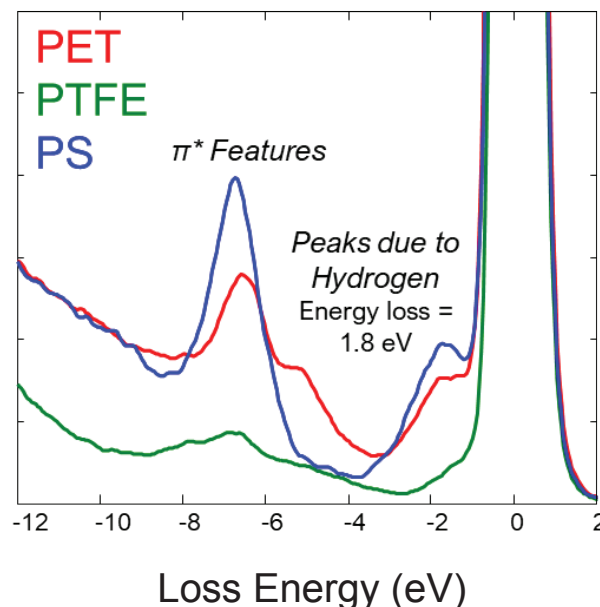
Analysis Examples

Bonding Chemistry Analysis by REELS

REELS is sensitive to hybridization of carbon. Energy loss peak due to π-->π* transition in graphite appears 6-8 eV lower than the elastic peak.
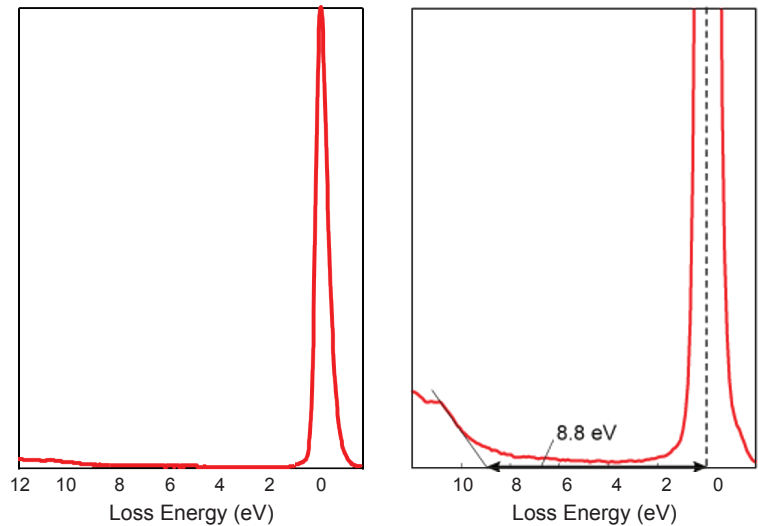
Hydrogen Concentration Measurement by REELS

Hydrogen-derived energy loss peak is present due to the rebound effect of hydrogen atoms. Relative concentration of hydrogen, which is not accessible by XPS, can be obtained from the intensity of this energy loss.

Band Gap Measurement by REELS

REELS spectrum of SiO_2 thermal oxide film (25 nm) on Si wafer. REELS can be used to calculate the band gap of SiO_2. The band gap is obtained from the intersection of a straight line originating from the background level and a linear fit to the onset of loss signal spectrum as shown in the zoomed-in REELS spectrum.

8.8 eV

Loss Energy (eV)

Loss Energy (eV)

REELS Hardware

The REELS upgrade is a dedicated electron gun with a tungsten filament and is operated using *SmartSoft* software. REELS sensitivity on clean Au foil is ≤ 0.5 eV FAT (constant energy resolution) and ≥ 1,500,000 /nA can be operated up to 2 keV.

System requirements: Windows 10

Dual Anode X-ray

Scanning electron gun or Ar-GCIB ion gun

REELS

Transfer Vessel

UV source

C60 or Ar-GCIB ion gun