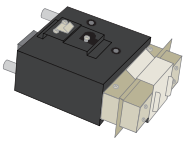
Open Counter for Low Energy Electron Counting Sensor : LE

Stationary sensor
Example: LE-6118



1. Brief description

This is the world's only sensor designed for surface analyses that is capable of counting low-energy electrons released into the air. RIKEN invented an initial model and Waseda University invented an improved version. Our company has commercialized them.

Detectable objects
[Substance surface analysis] Work function, surface contamination, film thickness, etc.

2. Structure and principles

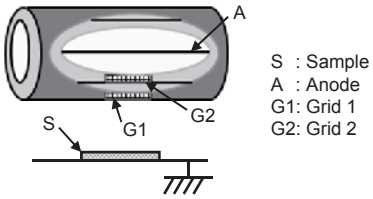
[Structure]

The sensor consists of two metal nets (G1 and G2), called grids, and an anode (A) made of a very thin wire.

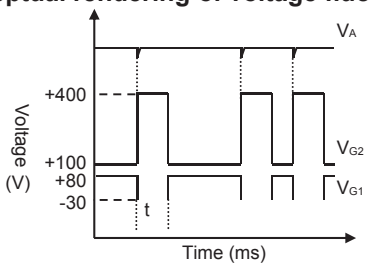
[Principles]

Low-energy electrons released from a sample enter the sensor through the grids. These electrons cause electric discharges near the anode, which are counted as discharge pulses. If a discharge continues, the sensor cannot count the second electron captured as the second pulse. As a solution to this, the sensor changes the voltages (VG1 and VG2) of G1 and G2 immediately after it has counted a pulse.
This stops the discharge to neutralize the cations generated in the discharge process and prevents the next electron from entering. After a certain duration, the sensor restores the voltages of G1 and G2 to count the next pulse. By repeating this process, the sensor counts electrons one by one.

[Structure]



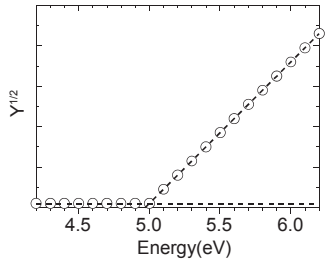
[Conceptual rendering of voltage fluctuations]



3. Features

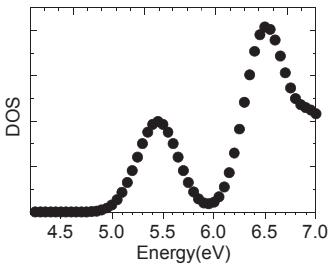
By combining a ultraviolet optical system, you can use this sensor to perform surface analyses in the atmosphere based on photoelectron yield spectroscopy. Typical photoelectron spectroscopy, a very effective method for obtaining information about the surface of a sample, requires a vacuum to measure electrons, which involves difficult measurement, and also requires expensive equipment. In contrast, this sensor allows you to easily make work function measurements and angstrom film-thicknesses measurements in the atmosphere, which had to be inevitably made in a vacuum before.

○ Photoemission characteristics



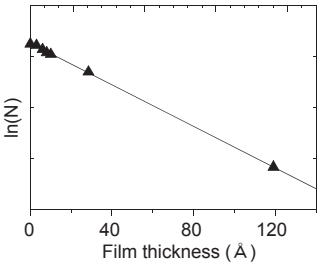
Measurement based on photoelectron yield spectroscopy provides a chart as shown in the figure. The vertical axis shows electron yield (Y) to the nth power; n is often 1/2 or 1/3. The point of intersection of the regression line of the linear part and the background is the threshold of photoemission.

○ Density of states



The electron yield differentiated with respect to the energy of the applied light is to reflect the density of states (DOS). This measurement provides the electronic state near the top of the valence band, which is an important element that determines various physical properties.

○ Film thickness and counting rate



If the surface is covered with another layer, the counting rate, N (In (N)), and the film thickness, T, are linearly correlated with each other. Based on this correlation, the sensor estimates the thickness of any very thin film (such as an oxide film or lubricating oil film) formed on the surface of metal or a semiconductor.

4. Applications (examples)

Atmospheric photoelectron yield spectroscopy
-Analysis of the electronic states of materials
-Measurement of the thickness and contamination of ultrathin films on solid surfaces

5. Products of this type (examples)

○Stationary products

... AC-2S, AC-3, AC-5

AC-2S