Application Note: 31053

X-ray photoelectron imaging of contaminated PTFE

Key Words

- Surface Analysis
- Co-axial Charge Compensation
- Parallel Imaging
- Source Defined Selected Area XPS

In many industries polymer films are rejected by quality control as a result of contamination of the surface. In this example, small black particles were observed on the white PTFE surface. The source of the problem could be removed if the nature of the contamination were known.

Thermo Electron Corporation's ESCALAB 250 was used to determine the nature and surface distribution of the contaminant. The instrument offers the unique combination of a source-defined, microfocused monochromator and parallel imaging capability.

The fast parallel imaging available from ESCALAB 250 ensures that the alignment of the monochromator beam is perfect before spectroscopic analysis begins.

A large area spectroscopic analysis of the contaminated PTFE sample using monochromatic X-rays resulted in a C 1s spectrum with a number of components, Figure 1. The major peak was due to CF_2, but there were a number of other peaks in the spectrum due to hydrocarbon and oxygen-containing organic species.

A spectrum was then taken from one of the contamination spots using a small monochromator spot. The overlay image shows the relationship between the CF_2 image and the size and position of the monochromator spot, Figure 3. The precise alignment of the X-ray beam on the contaminant can be seen from this image.

A source defined XPS analysis provides maximum sensitivity and ensures that X-ray flux only reaches the part of the sample being analysed.

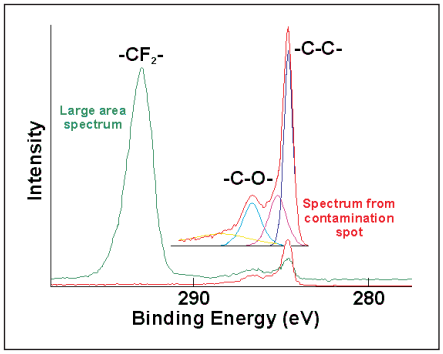

Figure 1: Comparison of a large area spectrum and a selected area spectrum from the contaminated PTFE. The selected area spectrum is taken from one of the contamination spots.

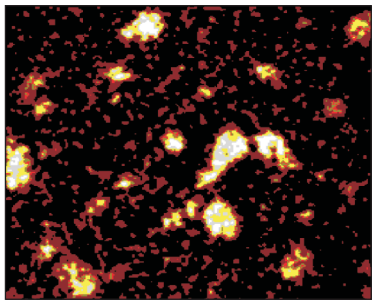

Figure 2: A C 1s image from the hydrocarbon component of the spectrum. This clearly shows the contamination spots

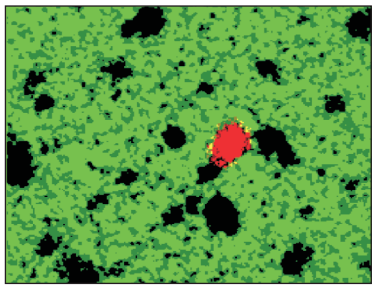

Figure 3: A C 1s image from the flourocarbon component of the spectrum (green) and an image of the monochromated X-ray beam (overlayed in red). The precise alignment of the X-ray beam and contamination spot can clearly be seen.

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