Surface Analysis in Packaging Applications

For your packaging solutions - in materials design, troubleshooting and for enhanced performance - use our surface analysis toolbox.

Packaging value chain and surface analysis

In the packaging value chain, surface chemical analyses provide answers to many of your needs.

Some examples:

Surface modification of packaging films
After using corona, flame or atmospheric plasma treatment, what is the effect on the surface chemistry and different chemical functionalities of the packaging film?

Adhesion problems in packaging
If you have adhesional failure between surfaces in a packaging application, e.g. layers in a laminate, how can the failure be detected to help you to improve the adhesion?

Ageing effect due to migration
Can some ageing effect you observe for a packaging application be due to migration of chemical components from the bulk to the surface? Surface analyses can detect the amount and type of chemical components, i.e. from raw materials or additives.

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Analyse surfaces in your packaging applications

- To answer to your needs we offer a complete solution by providing in-depth surface characterization for you.

- We use our unique combination of surface sensitive techniques, for faster and more reliable results.

- By combining different surface analysis methods, we can focus on characterization of surface chemistry or surface topography/structure - or both.

- In this offering the focus is on surface chemical analyses, using methods with different analysis depths and providing different types of surface chemical information.

Choose a suitable surface analysis technique to get the information you want - criteria for selection:

- **Surface sensitivity** - from what analysis depth do you need information - from nanometer or micrometer depth?
- **Chemical information** - what elements, type of functional groups, etc. - what information is required?
- **Quantification** - quantification in atomic %, is that important or is qualitative information sufficient?
- **Lateral resolution in images/maps** - what is needed for detection of small features or spots?
- **Topographical and surface structure**?

Examples from technical cases relevant for packaging:

Paper and fibers

1. Wood pulp fibers before and after bleaching
For the two fibers in the XPS image, specific signals are marked green for lignin and red for cellulose, hence the left fiber is unbleached (mainly lignin on surface), and the right fiber is bleached (mainly cellulose on surface). Surface coverage of lignin on paper can be calculated from quantitative XPS data.

2. Paper surface with fibers and vessel elements
Surface characterization over both large areas and in small spots provide useful information about e.g. patches on a surface. In this case SEM and XPS analyses were combined to characterize vessel elements and fibers on a paper surface (see SEM image).

3. Kraft pulp fibers with extractable materials
The ToF-SIMS image shows the distribution across a paper surface for one type of extractable material (sterols).

4. Uncoated copy paper
The distribution of different components across the surface of an uncoated copy paper is shown in the Raman image, with cellulose (green), pigment (red) and starch (blue).
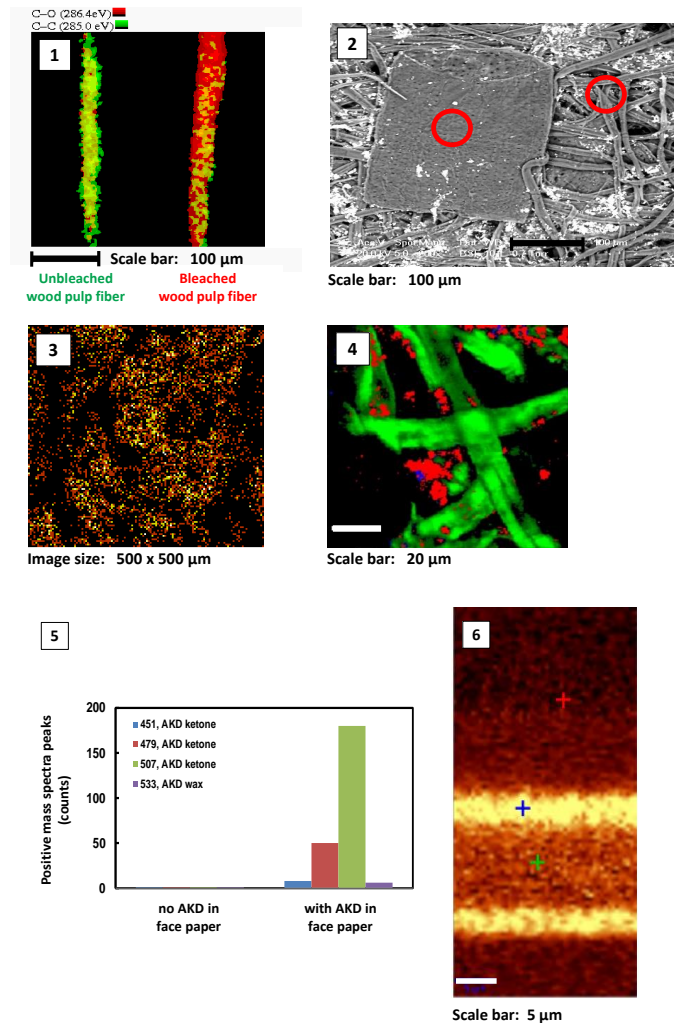
Sizing agents used in paper and board

5. Migration of paper components in paper labels
Reduced tack was noted after ageing of paper labels, and this was according to XPS and ToF-SIMS analyses caused by migration of sizing agent AKD (alkyl ketene dimer) from face paper to adhesive film. On the adhesive side different AKD signals were identified, hydrolyzed form (ketone) and AKD wax.

Flexible packaging

6. Identification of different polymer layers
The Confocal Raman Microscopy map shows identification of three different polymer layers (marked by red, blue and green crosses in the map), by comparing to Raman spectra of the different components. The advantage with the confocal technique is that no cross-section preparations are needed for these types of samples.

C–O (286.4eV)
C–C (285.0 eV)

Scale bar: 100 µm

Unbleached wood pulp fiber | Bleached wood pulp fiber

Scale bar: 100 µm

Image size: 500 x 500 µm

Scale bar: 20 µm

451, AKD ketone
479, AKD ketone
507, AKD ketone
533, AKD wax

Positive mass spectra peaks (counts)

no AKD in face paper | with AKD in face paper

Scale bar: 5 µm

Come to us if you need help to characterize different surfaces in your packaging applications.

Surface analysis methods with focus on surface chemistry are listed below with their surface sensitivities, i.e. analysis depths:

- **XPS** (X-ray Photoelectron Spectroscopy): **2-10 nanometer**

- **ToF-SIMS** (Time-of-Flight Secondary Ion Mass Spectrometry) for static SIMS: **1-2 nanometer**

- **Confocal Raman Microscopy** - allows for depth sectioning with a vertical resolution of about: **0.7 micrometer**

- **FT-IR** (Fourier Transform Infrared Spectroscopy) in attenuated total reflection mode (ATR): **0.5-5 micrometer**

- **EDX** (Energy Dispersive X-ray detector with Scanning Electron Microscopy, SEM): **0.5-5 micrometer**

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