Sharing knowledge...

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Elemental Analysis of Rubbers

X-ray fluorescence spectrometry (XRF) can help you precisely analyse the elements used in a rubber compound. It is a simple, accurate, non-destructive analytical technique that provides quantitative and semi-quantitative information. XRF can measure a wide range of elements in solid and liquid samples down to the parts per million level.

You can use this technique to reveal the exact composition of a rubber compound or as a process control tool. For instance, if you want to find out if your raw rubber was produced with a traditional Ziegler Natta catalyst or with a metallocene-based catalyst system. Or you want to identify what type of vulcanisation (sulphur, peroxide, radiation or other) is being used in a rival product.

How does XRF work?

When a sample is bombarded with X-rays the electrons in the inner shell or nucleus are excited and move away from it. The electrons in the other shells move towards the nucleus as they lose a specific amount of their energy. The energy that is emitted (photon) is specific to each element in the Periodic System. These energies (photons) will be detected by the XRF system so that a qualitative and quantitative measurement of the element can be performed. All of the elements ranging from carbon to uranium can be analysed in this way.

What can we do for you?

We have broad experience in using XRF to identify deposits or inclusions that can cause holes in profile surface of elastomers. Using XRF we can analyse:

- polymer additives
  - range m%: fillers, flame retardants, processing additives, pigments
  - range mg/kg: UV-stabilisers, corrosion inhibitors, thermal stabilisers
- catalyst residues in polymers
- the elements in small samples or in the particles that are present in samples (using XRF microprobe)
- determine the type of vulcanisation used for ethylene propylene diene rubber (EPDM), such as sulphur cure or other.

Sample size, sample preparation

The amount of sample needed for XRF analysis is usually 0.01-10 grams. With the XRF microprobe, however, XRF measurements can be performed on smaller samples. The microprobe can perform a quantitative analysis of small inclusions in polymer samples or compounds. Particles in a sample that are at least 10µm in size can be measured.

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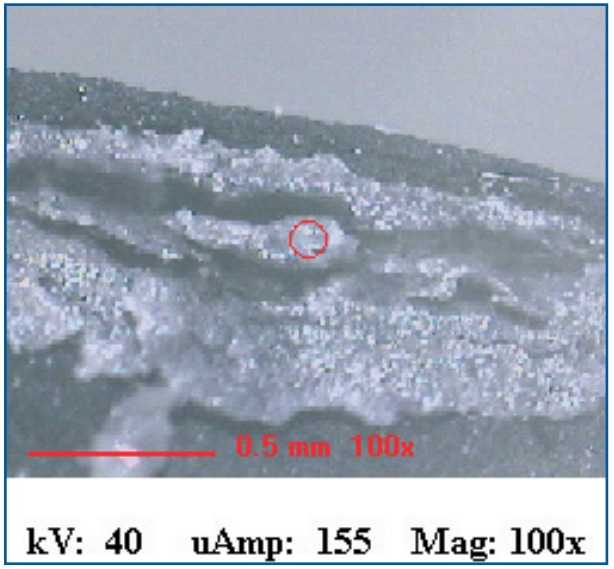
Analysing ash content

A quantitative analysis of the ash residue of an original sample can be performed using XRF. The ash content consists of inorganic material. For EPDM compounds these are usually the oxide forms of Zinc, Calcium, Magnesium, Silicon, etc. The fillers that can be (semi) quantitatively measured include chalk and talcum. We use a database to identify the type of talcum used in the compound.

Identifying inclusions of spots on a profile

In Figure 1, several spots (light areas) are present on a profile (dark area). An XRF measurement with the microprobe (spot size 40 µm) was performed in the spot (see red circle in Figure 1) and in the bulk of the sample. The XRF spectra are shown in Figure 2. The blue spectrum is from the bulk of the profile and the red spectrum is from the spot on the profile.



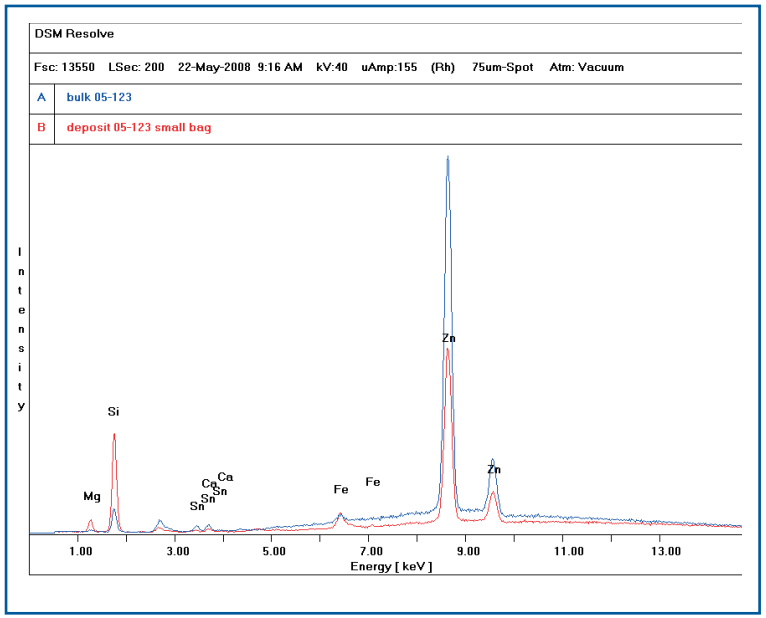


Figure 2: XRF measurement in the spot and at the bulk of a profile sample.

In the spot we observe, more Silicon, Magnesium and less Zinc is present compared to the bulk. This indicates that the light spots contain a higher concentration of talcum (H2Mg3(SiO3)4) compared to the bulk of the profile.

Stretch your thinking in polymers

We think about polymers differently because we understand the complete spectrum of polymers - from research and development to production and end of life disposal. Credit our decades of experience in materials analysis and processing, chemical engineering and safety testing, as well as product enhancement and polymer recycling issues. We can help you think beyond the way you're currently producing polymers.