Glass analysis using XRF spectroscopy

XRF spectra can be used as a way to measure the quality of glass.

Introduction

The most basic form of glass is fused silica (SiO2) but modern-day industries add different oxides and components to reduce cost, such as flux materials sodium sulfate and carbonate (~15%), a stabilizer like limestone (~10%) and other oxides like iron, chromium or copper.

The key question is how do we measure these additives for quality assessment? X-ray Fluorescence (XRF) is the best technique to detect even the minor concentrations of elements in a sample.

Sand, limestone, photochrom and sodium sulfate samples (left to right)

Photochrom, limestone, sodium sulfate and sand are the typical raw materials for glass production. This application note shows how you can prepare these raw materials for XRF analysis, using the Specac 25 Ton Manual press and the P6 ball-mill.

Method

To prepare the photochrom, limestone, and sodium sulfate, about 20g of each material needs to be ground to a fine powder with the P6 Ball-mill at 650 rpm for a few minutes. The best grinding materials are zirconium oxide or tungsten carbide for their strength.

Then take roughly 5 g of the powder, add 1g of wax binder, then mix again for 30 seconds at 650 rpm.

Finally, place the mixture into a 32 or 40 mm die with boric acid as a substrate. Once you've pressed the sample with the 25 Ton Press, your sample is ready to be analysed by an XRF Spectrometer.

Conclusion

Figures 1 and 2 show the typical XRF spectra for the samples. Some samples like sand are best analyzed as a fused bead, rather than a pressed pellet. Fusion is an effective technique that improves homogeneity and removes grain size effects.

However, the sand still needs to be ground into a homogenous and smoother powder.

Mix 1 g of sand with 5 g of the flux and grind in the P6 ball-mill. The mixture then needs to melt in a mold at high temperature. The resulting fused bead can now be placed in the XRF spectrometer. Figure 4 shows the XRF spectrum of sand.

The spectra tell the user how much of a particular element is present in the sample.

For instance, we can see that SiO_2 is the main component in sand, which is to be expected, while the main components in limestone are CaO and CO_2.

In this way, the XRF spectra can be used as a way to measure quality and make sure the material is within the company's specification and is perfect for RoHS screening.

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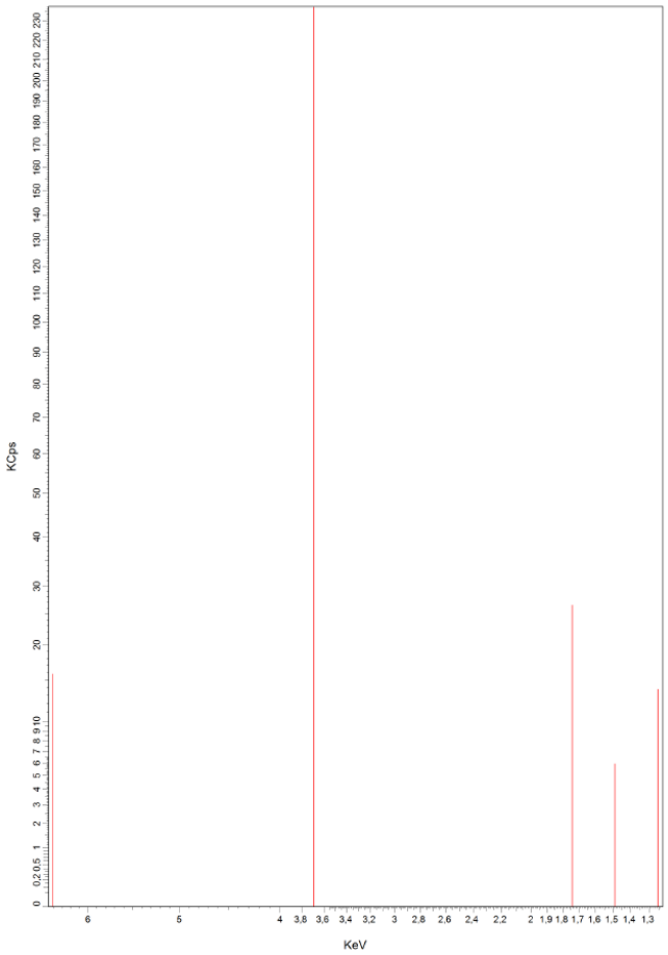

Figure 1: Limestone XRF spectrum

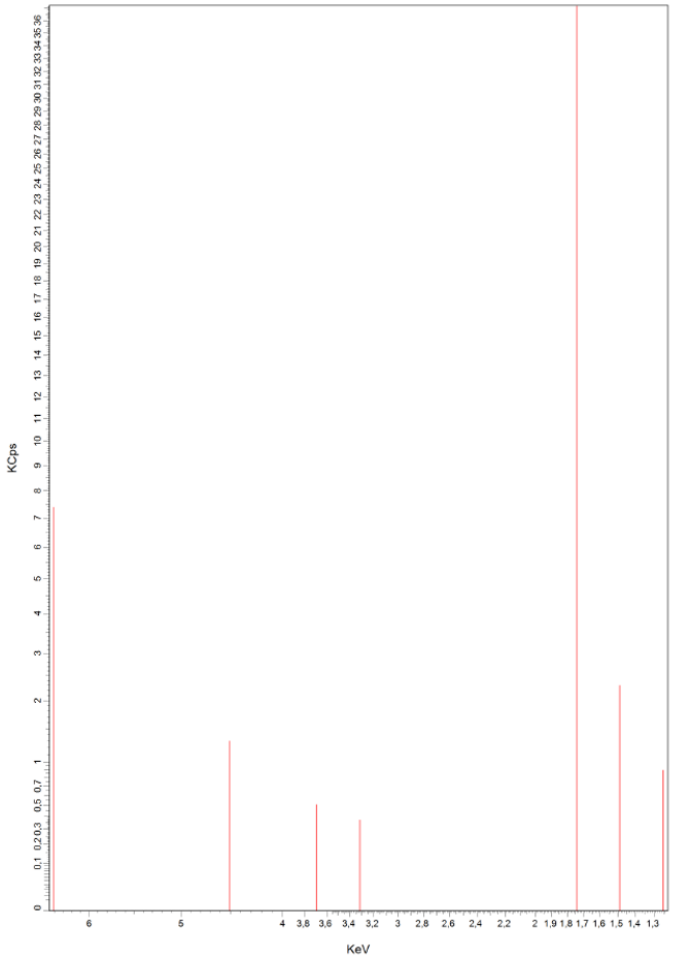

Figure 2: Sand XRF spectrum

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