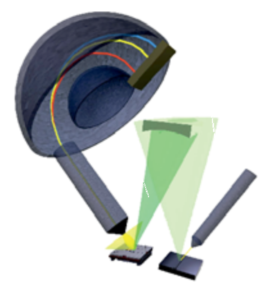
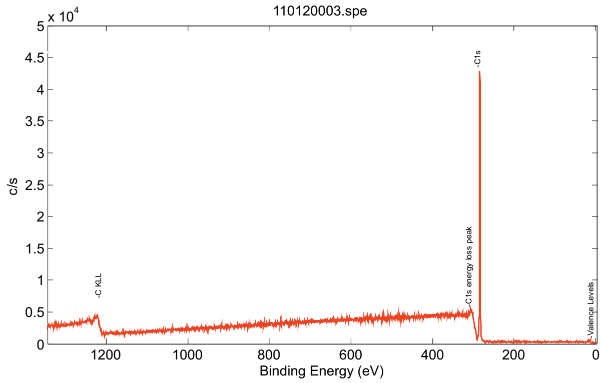
XPS COMPOSITION

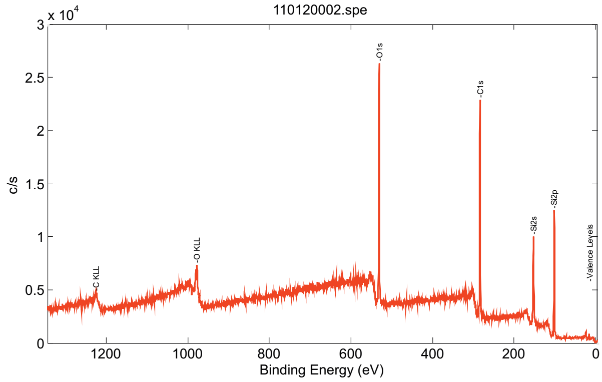


The most used application of XPS is the measurement of the composition of surfaces.

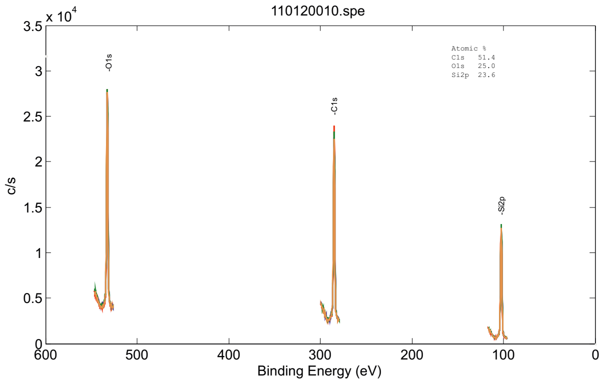
Measuring the number of photo electrons coming from a surface as function of binding energy gives an XPS spectrum. If we measure the energy range from 0 eV up to 1100 eV we will see peaks in this spectrum. The peaks are a fingerprint for the elements that the surface consists off. All peaks in the spectrum stand for electrons coming as either photo electrons or as auger electrons from the atoms in the substrate surface. The peak heights stand for the number of atoms of one element relative to other elements. Due to the fact that the relative sensitivity for each element is known, we can calculate from the areas or heights of the main peaks, the composition of the surface.
The easiest model used is that for a homogeneous, isotropic material. Then the measurements give straightforward the atomic concentrations of all present elements, except for hydrogen and helium, for both are not detectable by XPS.



One of the simpler spectra that can be measured with XPS is that of carbon. This could be of inorganic carbon or hydrocarbon material, but no other detectable elements. This spectrum shows 4 features: The C1s photoelectron peak with its energy loss peak, the C KMM auger electron peak and some valence levels.



A bit more complex is the spectrum of a silicone material. It consists of carbon, oxygen and silicon. The peak positions agree well with the values for PDMS (polydimethyl-siloxane)

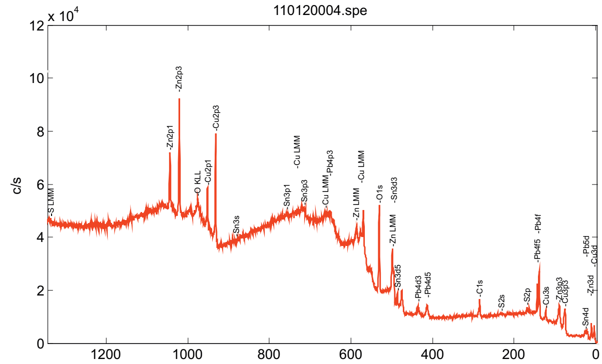


To calculate the atomic fraction of each element in the compound, the 3 main peaks were measured with less noise.

$$C_x = \frac{I_x / S_x}{\sum_i I_i / S_i}$$

C_x = Fraction of element x
I_x = Peak area of element x
S_x = Relative sensitivity of photoelectron peak x
Σ = Sum over all elements

The ratio for this compound
C:O:Si = 51:25:24
almost equal to the theoretical 2:1:1



Another, more complex spectrum. For the XPS operator it is necessary to identify all visible peaks in a spectrum.

C	O	S	Cu	Zn	Sn	Pb
23.6	44.8	3.3	11.4	13.7	0.7	2.7