

Structure and Composition

TNO innovation
for life

The expertise group Energetic Materials is equipped with several analytical techniques to investigate the structure and composition of materials.

X-ray fluorescence spectrometry (XRF)

With XRF a powder, material or liquid is loaded as a pellet or in a cup into the machine. The X-ray tube will excite the sample and depending on the elemental composition the sample will emit secondary photons with a specific energy and wavelength. This energy will reveal what elements the material consists of, and in which quantity.

Using the QUANT-EXPRESS method unknown samples can be analyzed without performing a calibration, with a detection limit around 0.1%. For specific materials it is possible to create a calibration for more accurate results which allows to determine concentration down to several ppm.



X-ray diffraction (XRD)

For research on crystalline materials X-ray diffraction (XRD) can be used. X-rays are diffracted at several angles which are characteristic for the crystal structure. The analysis of the combination of these angles reveals which crystalline structures are present in the sample. With measurements of sufficient quality and addition of an internal standard, the components can be quantified. This analysis technique is suited for both powders and solid materials.

Moisture content (by Karl Fischer titration)

For Karl Fischer water content determination we use the advanced and modern coulometer from Mettler Toledo. With this titrimetric method the moisture content of a sample can be determined accurately from ~1 ppm until 5%.



Particle size determination

With the laser diffraction setup from Malvern Panalytical the particle size distribution of solid samples can be determined, both dry and in suspension. The measuring range is 0.1 μm to 3.5 mm for dry samples and 10 nm to 2.1 mm for samples in suspension. For an accurate determination it is important that the refractive index from the sample and dispersant as well as the absorption index from the sample is known.



SEM-EDX

Using a scanning electron microscope detailed images of the sample of interest can be produced. It is also possible to determine the elemental composition of (parts of) a sample. For more information about the microscopy options, see the information sheet on microscopy.



CHN element analyzer

With the CHN element analyzer from Elementar the carbon, hydrogen and nitrogen content of a sample can be determined with ppm level accuracy. This method is mostly used for the determination of nitrogen in energetic materials, as this concentration is an important parameter for these type of materials.



If you see a potential application in one of your project for the use of these techniques please feel free to contact Wouter van de Steeg by e-mail or phone to discover the possibilities.

TNO Location The Hague

Ypenburg, Ypenburgse Boslaan 2
NL-2496 ZA The Hague
Postal address P.O. Box 480 NL-2501 CL
The Hague T +31 88 866 80 00