The primary X-radiation is generated in the X-ray tube, where an electrically-heated cathode emits electrons. Accelerated by high voltage to very high speeds, these electrons bombard the anode material, which generates the primary X-radiation.

The primary filter can further optimise the energy distribution of the primary X-radiation. Located directly after the primary filter is a shutter, which acts as a safety device if needed: when closed, the shutter prevents the primary X-radiation from reaching the measurement chamber.

The collimator (= aperture) restricts the diameter of the primary beam in order to subsequently excite a measurement spot of a defined size.

The primary X-radiation impacts the atoms on the sample surface and, in the process, ejects electrons from the inner electron shell. Filling the resultant voids, electrons from the outer electron shells emit a fluorescence radiation that is characteristic in its energy distribution for a particular material.

The energy dispersive detector measures the energy distribution of the fluorescence radiation. A multistage electronics circuit processes the measurement signals. Either proportional counter tubes or semiconductor detectors are used, depending on the design of the instrument. Their different characteristics are described below.

The test spectrum shows lines or peaks that are characteristic for the chemical elements in the sample.

The WinFTM® Software computes the thickness of the coating(s) and/or the analysis result and shows a video image of the sample. The special design of the optical and X-ray guidance systems enable precise viewing of the measurement location and measurement spot.

### Designs of X-Ray Detectors

**PIN-/SDD-semiconductor detector**

The photons of the fluorescence radiation generate free charge carriers (electrons and holes) in the semiconductor; their number is proportional to the energy of the photons.

**Proportional counter tube**

The photons of the fluorescence radiation generate electrical charge carriers (electrons and ions) through ionization in the counter tube gas; the number of the carriers is proportional to the energy of the photons.

### Application Characteristics of the Detector Types

**PIN-/SDD-semiconductor detector**

Excellent energy resolution. Even peaks that are very close to each other, such as those of gold and platinum, can be evaluated distinctively. Thus, this type of detector is ideally suited for the analysis of completely unknown samples.

**Proportional counter tube**

While the energy resolution is lower, the count rates are significantly higher, the benefits thereof are faster measuring times. The proportional counter tube is the best solution for routine measurements of known coating systems or alloys.