

P 6.3.5

X-ray energy spectroscopy

- P 6.3.5.1 Recording and calibrating an X-ray energy spectrum
- P 6.3.5.2 Recording the energy spectrum of a molybdenum anode
- P 6.3.5.3 Recording the energy spectrum of a copper anode
- P 6.3.5.4 Investigation of the characteristic spectra as a function of the element's atomic number: K-lines
- P 6.3.5.5 Investigation of the characteristic spectra as a function of the element's atomic number: L-lines
- P 6.3.5.6 Energy-resolved Bragg reflection in different orders of diffraction



Recording and calibrating an X-ray energy spectrum (P 6.3.5.1)

The X-ray energy detector enables recording of the energy spectrum of X-rays. The detector is a Peltier-cooled photodiode wherein the incoming X-rays produce electron-hole pairs. The number of electron-hole pairs and thus the voltage pulse height after amplification is proportional to the X-ray energy. The pulse height analysis is carried out with CASSY used as a multichannel analyzer (MCA-Box), which is connected to a computer (PC).

The object of the first experiment is to record the X-ray fluorescence spectrum of a target and to use the known energies for calibration of the energy axis. The target is made of a zinc-plated steel and emits several fluorescent lines.

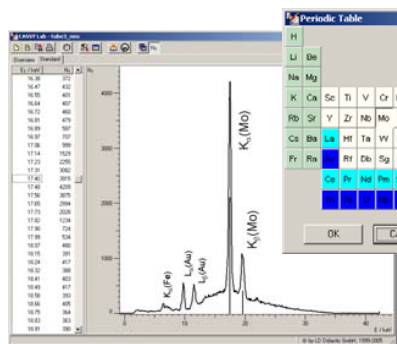
The second and third experiment use the calibrated detector to record emission spectra of either a molybdenum anode or a copper anode. The resulting spectrum shows the characteristic lines of the anode material and the bremsstrahlung continuum.

The fourth experiment demonstrates differences in the characteristic fluorescent K-lines (transitions to K-shell) within the X-ray spectra of different elements. These are used to confirm Moseley's law and show aspects of material analysis.

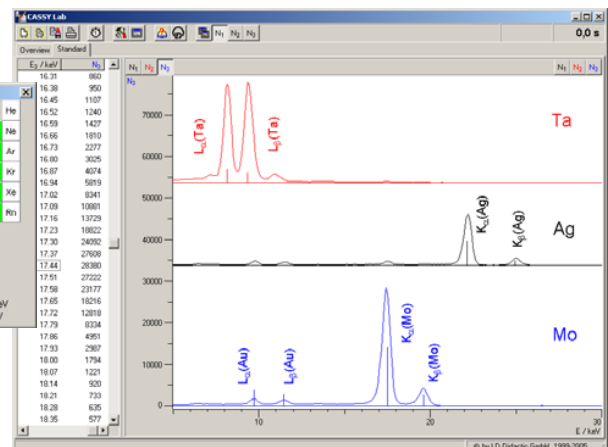
The fifth experiment shows similar characteristic fluorescent L-lines for heavier elements, demonstrating the X-ray emission from transitions to the L-shell.

Cat. No.	Description	P 6.3.5.1	P 6.3.5.2	P 6.3.5.3	P 6.3.5.4	P 6.3.5.5	P 6.3.5.6
554 811USB	X-ray apparatus	1	1	1	1	1	1
554 85	X-ray tube copper			1			
559 938	X-ray energy detector	1	1	1	1	1	1
554 844	Set of targets K-line fluorescence				1		
554 846	Set of targets L-line fluorescence					1	
524 010USB	Sensor-CASSY	1	1	1	1	1	1
524 058	MCA Box	1	1	1	1	1	1
524 200	CASSY Lab	1	1	1	1	1	1
501 02	BNC Cable, 1 m	1	1	1	1	1	1
	<i>additionally required:</i> PC with Windows 98/NT or higher	1	1	1	1	1	1

In the sixth experiment using the X-ray energy detector in Bragg geometry it is possible to observe different X-ray energies simultaneously, because Bragg condition is fulfilled for different orders.



X-ray spectrum of molybdenum anode (P 6.3.5.2)



X-ray fluorescence of different elements. (P 6.3.5.4/5)