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The Electron Macroscope, a simple Electron Beam Instrument

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The idea of this instrument is to use an electron beam to probe solid samples combined with modern sensor concepts.

An oscilloscope tube may be used as a guide-line for the production, focussing, and deflection of an electron beam for sample investigation in a vacuum environment. The spatial resolution will be better than 20μm judging from high resolution CRTs. The depth of focus is much higher than in optical devices which eases sample preparation and allows for the investigation of rough samples. Furthermore focussing and scanning can be performed by controlling voltages only.

The signals obtained from a sample under electron bombardment may be evaluated in the way used in electron microscopes, that is, secondary electrons, backscattered electrons, cathodo-luminescence, and characteristic X-rays. The first gives a topography contrast, the second an order number contrast, the third may inform about bond structures, the last yields compositional information from the uppermost 5 μm. Electrons can be observed using electron multipliers. Luminescence can be detected by photoelectric cells and X-rays can be evaluated using energy-dispersive X-ray detectors.

Although it is generally accepted that samples to be investigated by electron microscopy have to be electrically conducting or need a conductive coating, it is shown that this concept works even for electrically non-conductive, dry dust samples. Images and X-ray spectra are given as examples.