scanning electron beam. That adjustment is made by adjusting the scanning position of the electron beam **26** or by moving the sample **24** under test in the electron microscope. Proper orientation of the sample and beam is obtained by observing the maximum x-ray count rate at the detector. We have found experimentally that the x-ray transmission through the optic does not change greatly as the electron beam position is changed 10 to 20 micrometers. This implies that x-ray transmission in the optic is acceptable for typical electron scanning ranges utilized in most microanalysis applications.

The present invention is mainly an illustration of the principle of focusing x-ray radiation on a microcalorimeter detector in an x-ray spectrometer and, therefore, is accompanied by a description of specific embodiments. It will be apparent to those skilled in the art that various modifications, substitutions, additions and the like can be made without departing from the spirit of the invention, the scope of which is defined by the claims which follow and their equivalents.

What is claimed is:

1. An x-ray spectrometer for determining the set of characteristic energies produced by a sample under test, said spectrometer having improved collection efficiency comprising:

- an excitation source to excite the emission of x-ray radiation from said sample;
- a microcalorimeter x-ray detector responsive to incident x-ray radiation for producing an output signal representing the energy of the x-ray events incident at said detector; and
- an x-ray lens placed between said sample and said detector, said lens having a first focal point positioned on said sample for collecting a large solid angle of said x-ray radiation and a second focal point positioned on said detector for focusing said x-ray radiation on said detector.

2. The x-ray spectrometer of claim **1** wherein said x-ray lens is a polycapillary lens.

3. The x-ray spectrometer of claim **2** wherein said x-ray lens has a transmission efficiency that varies with respect to x-ray energy, and said spectrometer includes calibrating means to compensate for variations in the transmission efficiency of said x-ray lens.

4. The x-ray spectrometer of claim **3** further comprising an alignment means coupled between said sample and said x-ray lens for aligning said second focal point of said x-ray lens on said detector in accordance with the maximum count of said x-ray events with respect to a fixed time interval.

5. The x-ray spectrometer of claim **4** wherein said excitation source is an electron microscope which bombards said sample with electrons causing said sample to emit x-ray radiation.

6. The x-ray spectrometer of claim **1** wherein said excitation source is an electron microscope which bombards said sample with electrons causing said sample to emit x-ray radiation.

7. The x-ray spectrometer of claim **6** wherein said x-ray lens is a polycapillary lens.

8. The x-ray spectrometer of claim **7** wherein said x-ray lens has a transmission efficiency that varies with respect to x-ray energy, and said spectrometer includes calibrating means to compensate for variations in the transmission efficiency of said x-ray lens.

9. The x-ray spectrometer of claim **1** further comprising an alignment means coupled between said sample and said x-ray lens for aligning said second focal point of said x-ray lens on said detector in accordance with the maximum count of said x-ray events with respect to a fixed time interval.

10. The x-ray spectrometer of claim **9** wherein said x-ray lens is a polycapillary lens.

11. The x-ray spectrometer of claim **10** wherein said excitation source is an electron microscope which bombards said sample with electrons causing said sample to emit x-ray radiation.

12. A method of spectroscopic materials analysis comprising the steps of:

- providing for the excitation of a sample under test to excite the emission of x-ray radiation;
- providing for the collection of said x-ray radiation from a sample under test by an x-ray lens wherein a first focal point of said lens is positioned on the surface of said sample under test; and
- providing for the detection of said x-ray radiation in a microcalorimeter wherein a second focal point of said lens is positioned on said microcalorimeter.

13. The method of claim **12** wherein the transmission efficiency of said x-ray lens varies with respect to x-ray energy, said method further including the steps of:

- providing a translating stage for moving said x-ray lens out of the line of sight of said detector and measuring the x-ray spectra obtained at said detector;
- providing said translating stage for moving said lens into the line of sight of said detector and measuring the x-ray spectra obtained at said detector; and
- mathematically operating on the spectra obtained without said lens and the spectra obtained with said lens to determine calibration factors to compensate for the transmission efficiency of said lens.

14. The method of claim **12** further including the steps of:

- providing a translational stage to align said detector with said x-ray lens to establish the position of said detector at said second focal point by observing the position at which the maximum x-ray count rate is achieved at said detector; and
- providing for the adjustment of said first focal point at said sample by observing the position of said sample at which the maximum x-ray count is achieved at said detector.

15. The method of claim **12** wherein the step of providing for the excitation of said sample is accomplished by the bombardment of said sample in an electron microscope and further including the step of:

- adjusting the location at which said bombardment of said sample occurs to coincide with the location of said first focal point by observing the position at which the maximum x-ray count is achieved at said deteccor.

16. The method of claim **12** further including the steps of:

- providing a translational stage to align said detector with said x-ray lens to establish the position of said detector at said second focal point by observing the position at which the maximum x-ray count rate is achieved at said detector;
- providing for the adjustment of said first focal point at said sample by observing the position of said sample at which the maximum x-ray count is achieved at said detector; and
- wherein the step of providing for the excitation of said sample is accomplished by the bombardment of said sample in an electron microscope and further including the step of: