

# A Multiple-electron-beam imaging technique for surface inspection

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Various multiple scanned electron beam systems aimed at lithography have emerged in recent years [1], however, the use of simultaneous multiple electron beams for surface inspection has not yet been explored. Normally, when multiple electron beams are scanned over the specimen at close proximity, their scattered electrons mix with one another when forming the output signal, even if multiple detectors are used.

This paper presents a multiple-electron-beam imaging technique, which is able to simultaneously process images from an array of multiple scanned beams which either overlap or which strike the specimen in close proximity. Advantages of this technique include fast specimen inspection by subdividing it into multiple scan areas, and allowing large scale as well as detailed imaging simultaneously. The beams are set at slightly different illumination angles and energies with respect to one another, and wide angle BSEs are used to form the output signal. Fig. 1 shows a schematic diagram of the technique, where an energy spectrometer is used to distinguish the wide-angle (0 to 3 degrees with respect to the surface of the specimen) BSE signals from each beam at the output.

Monte-Carlo simulations will be presented to demonstrate the in-principal feasibility of this method. Fig. 2 shows that two separate beams, a 6 keV beam at normal incidence, and a 5 keV beam at an illumination angle of 85 degrees are predicted to have distinct (non-overlapping) energy spectra, showing that it should be possible to separate their scattered electrons by an energy spectrometer.

## References

- [1] M. Mankos, S. Coyle, A. Fernandez, A. Sagle, P. Allen, W. Owens, J. Sullivan, and T.H.P. Chang, *J. Vac. Sci. Technol. B* **18**(6), 3010 (2000)

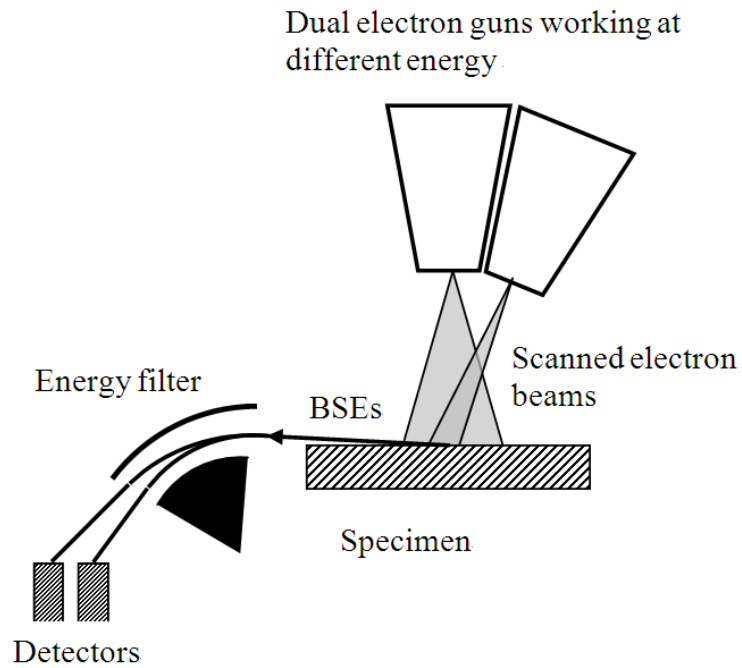


Fig 1: Schematic layout of a dual electron beam system with two independent image detectors

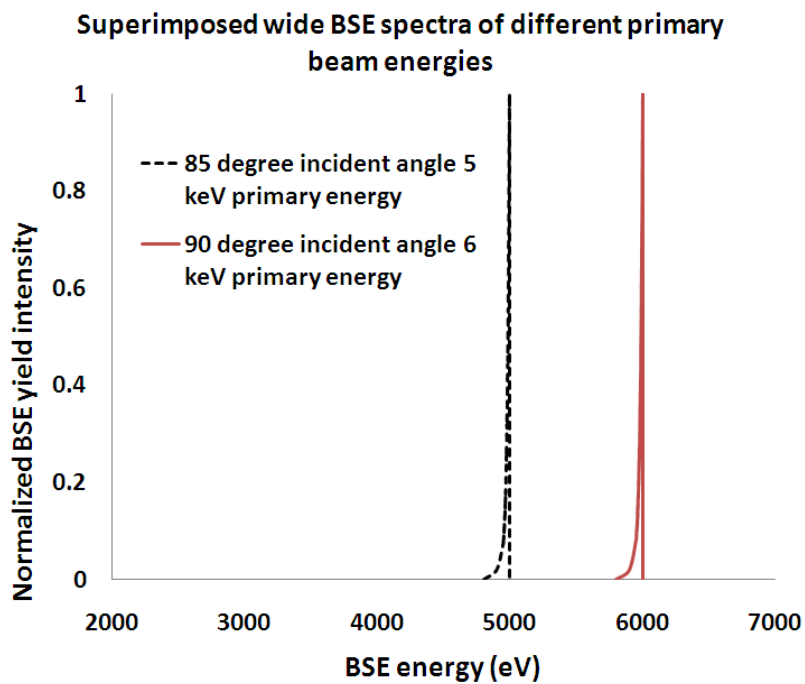


Fig 2: Simulated wide angle BSE energy spectra of 5 keV primary beam with 85° incident angle, and 6 keV primary energy with normal incident angle.