

A modularized miniature electron beam column array for parallel lithography

A. Khursheed, and T. Luo

Centre for Integrated Circuit Failure Analysis and Reliability
National University of Singapore, 4 Engineering Drive 3, Singapore 117576

Many designs of parallel scanning electron beam systems aimed at lithography have been published in recent years [1], however, the use of array of modularized electron beam columns for parallel ebeam lithography using permanent magnetic lenses has not yet been explored.

This paper presents designs and results of a multiple-electron-beam column array, which uses modularized and miniaturized electron beam columns with permanent-magnet lenses. A single column is manufactured and tested on a lens array using a Schottky field emission gun in order to achieve best results and reliability. This column is able to achieve high resolutions of 2nm, high beam current of 1nA, and a large range of landing energies from 0.5keV to 10keV.

The first step for an ebeam lithography system to calibrate the beam is to achieve a high resolution images, and we have fine-tuned and captured high quality SEM images at different focusing conditions. Fig. 1 shows the mechanical structure of 2X2 array of modularized columns using permanent-magnet lenses. Fig. 2 shows an example of Tin sphere on carbon image from the modularized column using 1kV landing energy, 1nA beam current, and a primary energy of 12kV.

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)

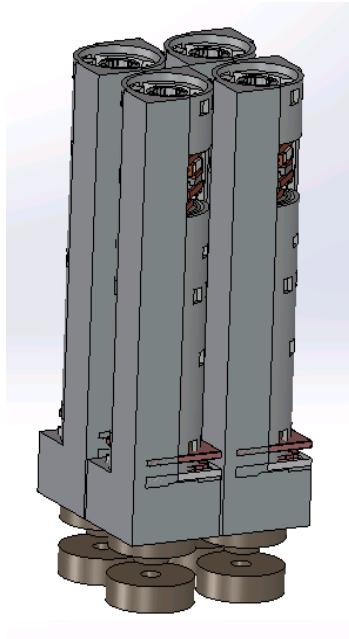


Fig 1: Mechanical drawings of 2X2 array of modularized columns using permanent-magnet lenses

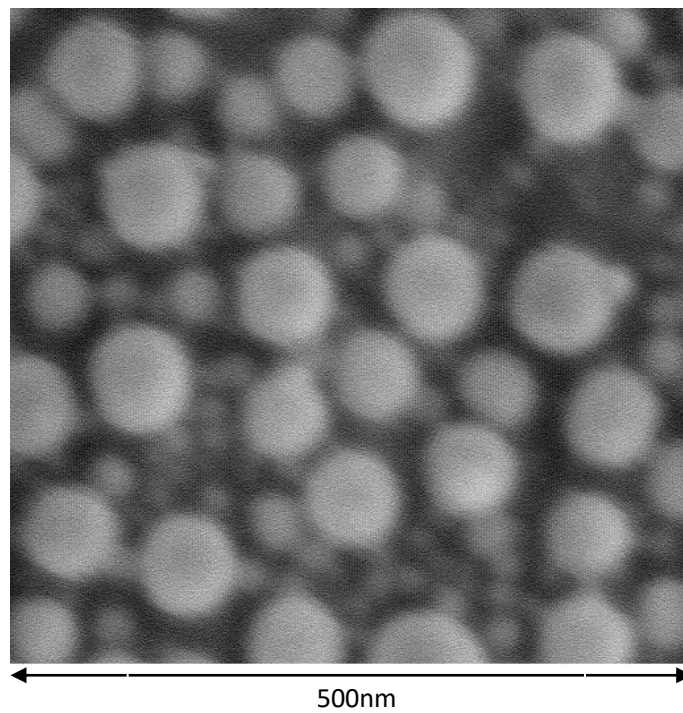


Fig 2: Tin sphere on carbon image from the modularized column with 1kV landing energy, 1nA beam current, and a primary energy of 12kV