

Design and experiment of a multi-beam electron source

Lixin Zhang^{1,a}, Weixia Zhao¹, Junbiao Liu¹, Bohua Yin¹, Li Han¹

¹ Institute of Electrical Engineering Chinese Academy of Sciences, Beijing 100190, China

^a E-mail address: zhanglx@mail.iee.ac.cn

In recent years, high-throughput, large-area microscopic imaging based on multiple electron beams has been developed ^[1,2], promoting progress in related fields such as life sciences, neuroscience, and semiconductor inspection^[3,4]. The multi-beam electron source plays a key role in such high-throughput setups.

In this work, a multi-beam electron source based on a thermal field electron gun has been developed. The Schottky emitter provides a reasonably constant angular current density. Within this angular current density, a collimator is used to manipulate the divergent beam. The collimated beam then impinges on an aperture array, which splits the single beam into multiple beams, and these are subsequently focused by a micro-arrayed Einzel lens (MAEL). Both the aperture array and the MAEL are fabricated using MEMS technology. To achieve high-precision assembly of the MEMS devices, we developed a dedicated assembly tool for the multi-aperture, multi-layer structure, achieving a positioning error of less than 500 nm. In the experiment, a 10×10 grid of electron beams was obtained, and the spot sizes could be adjusted by varying the focusing voltage applied to the MAEL (see Fig. 1).

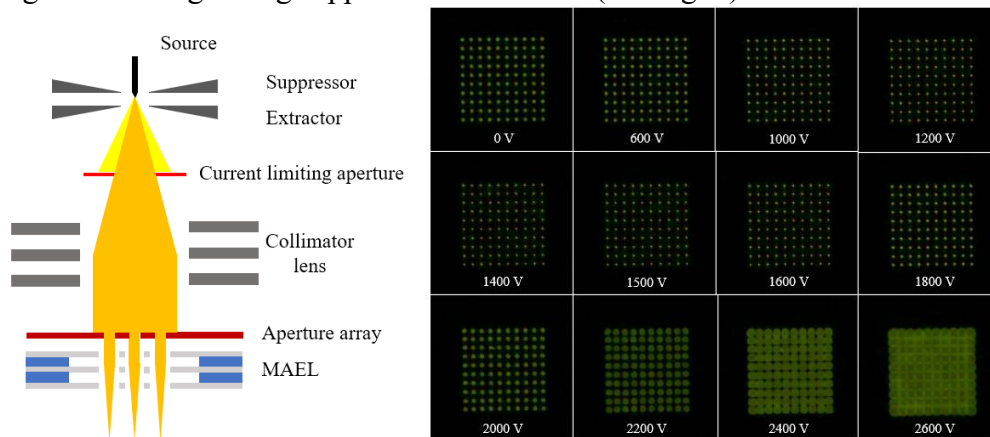


Fig 1 Left: Schematic design of the multi-beam electron source. Right: The experimental results of the multi-beam electron source.

References:

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