

MINIATURIZATION OF AN ELECTRON GUN WITH COLD FIELD EMITTER FOR A SCANNING ELECTRON MICROSCOPE

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ABSTRACT

There have been several attempts to miniaturize SEMs since long, from theoretical investigations for miniaturizing electron optical components [1], to fabrication of miniaturized SEM columns [2],[3]. In semiconductor technology, miniaturisation of SEMs has the potential to operate many such SEMs on the same wafer at the same time, thus increasing throughput in the manufacturing process and thereby saving costs.

One important step for miniaturisation of SEMs is the miniaturisation of the electron gun. We report on our progress to fabricate such a miniaturized gun by MEMS technology on a single chip. Our gun design consists of the electron emitter, extraction electrode, and alignment and stigmator electrodes. The electron emitter is fabricated by laser machining of a silicon wafer with consecutive chemical processing to sharpen the emitter tip, enabling cold field emission of electrons [4]. The extraction, alignment and beam shaping electrodes are lithographically generated metallic flat fields on an oxidized silicon wafer, the oxide layer providing the necessary electrical insulation between the electrodes. As these electrodes usually are part of the column in a conventional SEM, our approach of implementing several electron optical elements into the electron gun allows easier and smaller construction of the miniaturized SEM column.

For the fabrication of a complete column of a miniaturized SEM we collaborate with a group of the Wroclaw Univ. of Science and Technology [5]. They provide the scanning and focusing elements of the miniaturized SEM, together with a miniaturized vacuum pump. The power supplies and control units for the miniaturized scanning elements are also provided by this group.

References

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