Contribution ID: **234**                                                                                     Type: **Either**

# Electron beam lithography. Analysis and control of process variables through testing and verification by SEM images.

Electron beam lithography is an essential tool for fabricating micro and nano-scale devices, and an unlimited number of devices can be developed, such as sensors, MEMS, NEMS, and antennas, among others. These designs can modify the electrical, magnetic, optical, thermal, and mechanical properties of some materials; to achieve this, it is necessary to use this lithography technique, requiring exceptional control of the different variables that influence the whole process. The resist, the electron beam, the etching area, the exposure times, the shape and direction of the beam, and the development of the resist are some issues that involve one or more variables to be controlled in this process. In this work, we show the different designs created by this means in the SEM laboratory of CIACYT, the control of each of the variables, and how they individually affect our designs through SEM images. One of the objectives of this work is to obtain the most accurate parameters for each situation, depending on the shape and size of the designs, seeking to standardize a method of evaluating designs prior to lithography to improve the structures created in terms of quality and reduce manufacturing times, as well as reduce unnecessary waste of resources. The second objective is to achieve the smallest structures that our equipment allows. It was possible to obtain images demonstrating how each of the controlled variables influences the engravings, and by controlling these, it was possible to correct and obtain more defined and better-quality structures. Results are shown for simple circle-shaped, ranging from 86nm to 3μm, 40 nm thin lines, as well as more complex structures in the shape of asterisks or interdigitated circuits and the arrays in the shape of a matrix of some of those designs that can work as antennas and sensors.

## Keywords

nanotechnology, Lithography, Electron Beam, SEM, nanofabrication

## Reference

Mohammad, Mohammad & Muhammad, Mustafa & Dew, Steven & Stepanova, Maria. Fundamentals of Electron Beam Exposure and Development.(2012). https://doi.org/10.1007/978-3-7091-0424-8_2

## This work was supported by

## Author approval

I confirm

## Author will attend

I confirm

**Authors:**   Mr RAMÍREZ, Eliseo (Instituto de Investigación en Comunicación Óptica);  Dr CRUZ HERNÁNDEZ, Esteban;  CUEVAS LARA, José Antonio (Laboratorio Nacional de Ciencia y Tecnologia de Terahertz);  Mr MORENO, Juan R (Laboratorio Nacional de Ciencia y Tecnologia de Terahertz);  Ms ENRÍQUEZ RAMOS, Kristal Esmeralda (Laboratorio Nacional de Ciencia y Tecnologia de Terahertz);  Dr VIDAL BORBOLLA, Miguel Ángel (Coordinación para la Innovación y Aplicación de la Ciencia y la Tecnología)

**Presenter:**   CUEVAS LARA, José Antonio (Laboratorio Nacional de Ciencia y Tecnologia de Terahertz)

**Session Classification:**  NANOSTRUCTURES

**Track Classification:**  Nanostructures