

Tool for automating the process of nanofabrication using focused-ion beam

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Nanophotonics has experienced a tremendous growth in the past decade largely due to the development of nanofabrication techniques, such as electron-beam lithography, reactive ion etching, and focused ion beam milling. Specifically the attention in this work is drawn to the technique of focused ion beam milling. In this technique, a tight beam of accelerated ions impinges on a sample surface and removes locally parts of the sample material, i.e. ion beam drills nanoscale holes with a typical diameter of 10-50 nm in the sample. Many nanostructures used in experiments can be viewed as a set of these holes with specific in-plane coordinates and depth. Therefore, in order to fabricate a particular nanostructure, it is sufficient to specify the set of holes to be milled together with their parameters. Instead of typing these parameters manually for each hole, the list of parameters for all the holes can be generated automatically given the final nanostructure geometry. We have developed a Matlab-based tool that can automatically generate a list of parameters, so-called stream file, which can be directly uploaded to the control software of the focused ion beam setup (FEI Nova 200). Current capabilities of the tool include generation of stream files for arrays of circular nanoholes and sets of slot or v-groove shaped trenches. In addition, the tool includes a graphical user interface. We plan to use the developed tool to facilitate the fabrication of nanophotonic waveguides which will serve as a key part of a nanoscale quantum register. In the future, we are planning to expand the tool capabilities for other shapes of nanostructures and turn it into an online application available on nanohub.org.