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The College of Graduate Studies and the College of Engineering Cordially Invite You to a

Master Thesis Defense

Entitled

A COST EFFECTIVE DIRECT WRITING LASER SYSTEM FOR RAPID PROTOTYPING OF MICROFLUIDIC DEVICES

by

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Abstract

This study is conducted to highlight the improvement in technology of manufacturing microstructures using maskless lithography technique. Direct laser writing technique was implemented, and a major section of this study is carried out on an experimental slant. Variables that were not covered experimentally were studied using lithography simulation software, GenISys – LAB. The aim of this study is to fabricate and analyze cost effective maskless lithography apparatus to ensure rapid prototyping and optimize the system to be used for at least two negative photoresist materials. A parametric study was carried out determining the best operating conditions from both perspectives of direct laser writing and material process parameters. All parameters were studied experimentally, but the impact of depth of focus was illustrated using lithography simulation. Using direct laser writing system, complex designs were manufactured. The developed system had a maximum writing speed of 0.834 mm/s. The minimum line width produced using optimized operating conditions was 3.94 µm. Experimentally, increasing laser intensity, increased the line width and by increasing post bake timings, it was observed that less laser intensity was required. Simulation results showed that depth of focus plays a crucial role in manufacturing good quality 3D resist profile. We developed a cost-effective direct laser writing system as a part of studying maskless lithography process for rapid manufacturing. The total cost associated to develop this system was AED 4800 ($1307). This system was optimized to be used with two negative photoresist materials. A significant contribution of our work is through cost-effectiveness and performance to produce complex designs using a maskless lithographic process. This study will provide an opportunity for researchers to use their innovative designs with faster and cheaper methods of prototyping microdevices.

Keywords: maskless lithography, photoresist, exposure dosage, line width, depth of focus, numerical aperture, pre-baking, post baking.