“Microfabrication Techniques: the Route from Hard 2D to Soft 3D Devices”

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Monday August 15, 2016 (11 a.m.) at UNM Center for High Technology Materials (CHTM), Rm. 101

ABSTRACT: Microfabrication techniques have become mature in engineering of 2D devices primarily made from non-stretchable materials such semiconductors and metals. However over the last two decades new methods such as 3D printing, soft lithography, and substrate conformal imprint lithography have been adopted for fabrication of soft and 3D structures. Certain applications such as the need for flexible and wearable electronics, and medical implants/devices have played a major role in this trend. However integration of these well-developed but insulated techniques has not been fully achieved. This work provides a summary of different technologies such as 2D hard lithography used in semi-conductor industry, 3D printing employed in rapid prototyping, solution casting used in fabrication of catheters, their drawbacks and possible routes to integrate them. Applications in medical implants are also discussed which demand a combination of these technologies.

Seyedhamidreza Alaie received his B.S. and M.S. degrees in Mechanical Engineering in 2003 and 2007, respectively. He also received his M.S. degree in Optical Science and Engineering and his Ph.D. in Engineering from University of New Mexico, in 2014 and 2015, respectively.

From 2003 to 2009, his research was focused on functionally graded plates, finite element analysis, MEMS, and buckling of stiffened shells. From 2009 to 2015 he performed research on Phononic Crystals, MEMS, heat transfer at micro/nanoscale, miroresonators and nanostructured materials with applications in thermoelectrics and energy harvesting. In 2015 he started as a postdoctoral associate at the department of radiology of Weill Cornell Medicine, and Dalio Center of Cardiovascular Imaging of Newyork-Persbyterian & Weill Cornell Medicine. Thereafter he researched on integration of soft lithography, hard lithography and rapid prototyping techniques for fabrication of different soft implants for cardiovascular diseases. His is currently investigating on micro patterning of soft devices with arbitrary shapes for engineering of friction, and soft inflatable occlusion balloons for the left atrial appendage.