Surface Micromachining Processes using Non-lithographic Technologies

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Conventional MEMS fabrication relies heavily on planar lithography and IC technology. While these techniques are well-suited for relatively flat devices such as the semiconductors, they are drastically limited in the design and fabrication of three-dimensional devices such as MEMS. From a commercial viewpoint, the semiconductor paradigm is also a poor fit for MEMS because the lower volume and demands make it more difficult to offset the high production costs. Ridding MEMS fabrication of its reliance on such techniques may introduce several advantages, namely a wider base of substrate materials and decreased costs.

Our project investigates severing MEMS fabrication from the semiconductor paradigm via non-lithographic technologies. We have previously shown how MEMS can be used for the direct patterning of small molecular organics [1]. Using similar concepts, we intend to show that surface micromachining can also be achieved.

The first stage of the project is to directly pattern a structural layer over a spacer and successfully release a cantilever. We have successfully patterned metal silver over various spacer materials, including polyethylene glycol (PEG), polyvinyl acetate (PVA), and UNITY™ sacrificial polymer, and we are currently working on the release process. This technique will ultimately be used to construct simple structures, such as cantilevers and bridges, to test the structural material’s mechanical properties. The next stage of this project will consist of using this process to fabricate cantilevers and integrate them with other non-lithographic techniques to fabricate an accelerometer. Subsequent stages will consist of creating a library of non-lithographic processes so that entire MEMS devices can be fabricated without the use lithography.

REFERENCES