Thermal Pattening of Thermoresponsive Polymers

Host Professor Pr. B.J. KIM
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Context

Thermal Scanning Probe Lithography (TSPL) is a versatile technique to write features at nano to micro scale into thermosensitive resists by means of a hot atomic force microscope tip [1]. It has been shown, that this technique allows rapid prototyping of 3D structures into poly-phthalaldehyde which can be transferred into silicon [2,3]. Our aim is to improve the resolution, throughput and 3D capability of TSPL.

Objective & Methods

We have following objectives in this project. First to study fundamentally the decomposition dynamics of thermosensitive polymeric resists, and second use these data for further improvement of the TSPL resolution and 3D capability. To this end, we designed, fabricated, simulated and characterized dedicated microheater devices in Kim Lab (IIS, University of Tokyo).

Results

In a first step we fabricated and analyzed Pt micro-heaters which can be used to characterize the thermosensitive resists in conjunction with thermal scanning probes. Figure 1 a) shows the cross-section of the microheater device (top) and the dedicated Pt micro-heater on a glass substrate (bottom). The heaters were fabricated by photolithography and lift-off.

Figure b) shows the heat distribution across the micro-heater which was measured by infrared thermal microscopy. The heating power was in the range from 90-640mW.

First results look promising and allow for further collaboration between Kim-Lab (University of Tokyo) and Microsystems Laboratory (EPFL)

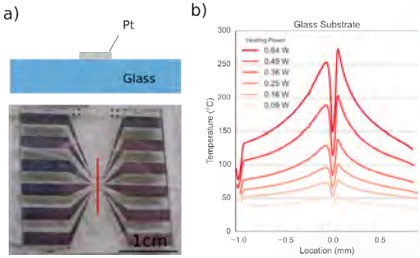

Fig. 1. a) A cross-section sketch (top) and a sample Pt heater on glass (bottom) are shown. The red line indicates the infrared microscopy measurements across the heater. b) Infrared microscopy measurements of the heat distribution across the heater at different heating power(in grey).

References

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[2] A. W. Knoll et al. Advanced Materials, 20, (2010)
[3] H. Wolf et al. Journal of Vacuum Science & Technology B, 33, (2015)