Reference: AN003

Using the Dip Pen Nanolithography® Process to Make NIL Master Stamps

Technology Summary

The Dip Pen Nanolithography (DPN®) process can readily be used to make a master stamp for use with nanoimprint lithography (NIL). By writing a DPN pattern of alkanethiol onto a gold film, using the NanoInk NSCRIPTOR™ DPN System, one can effectively create a structural template that serves as an etch-resist mask for subsequent processing into a 3-D stamp. Because NanoInk has scaled up the DPN process with multi-probe technology, the NSCRIPTOR System is an affordable solution for the quick and simultaneous fabrication of multiple high-resolution NIL master stamps.

A Problem of Economics

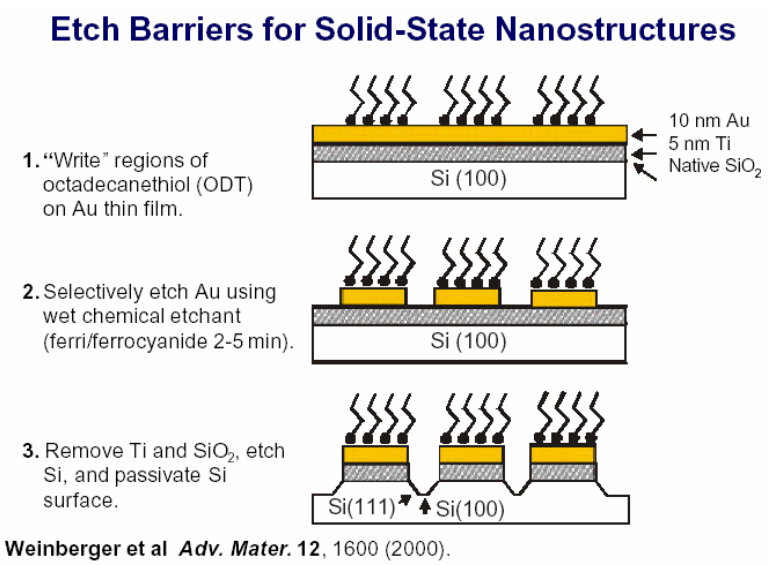
Using electron-beam lithography (e-beam) to make NIL masters is expensive and demanding. One needs access to costly facilities and a high level of expertise, or alternatively, one can contract out this work at a high cost of > $5,000/sample with a 6 week turn-around time. Either way, the effort and costs of making NIL masters with e-beam technology is significant.

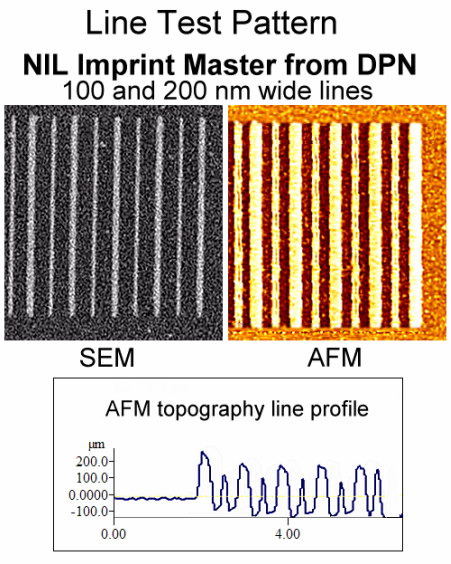
NanoInk Solution

NanoInk's NSCRIPTOR System can be purchased for around $200,000, and in combination with standard chemistry lab facilities, one can produce a high quality NIL master stamp in less than 4 hours. Thus, the NSCRIPTOR will quickly pay for itself, relative to the cost of ownership with e-beam, and the NanoInk approach is much faster that contracting out e-beam work to others.

Method of Choice

Below left, we see the basic etching methods of producing a stamp. First, a DPN etch-resist mask is patterned. Then the sample is chemically etched, followed by reactive ion etching in order to create final imprint structures around 200 nm deep. Below right, we see the SEM and AFM data from a NIL master stamp, patterned via DPN.





Benefits

- DPN technology allows one to create nanoscale patterns with instrumentation that is easy to use
- The process of creating NIL masters from DPN patterns is well developed and produces quick results
- There is no unwanted "proximity effect" in writing closely spaced parallel lines, unlike with e-beam
- The cost of buying, operating and maintaining the NSCRIPTOR System is much lower than for e-beam

For more information including pricing, please contact NanoInk Sales Department at sales@nanoink.net or 1-847-679-NANO.