Patterning Surfaces

• Different techniques can be sorted into two main categories:
  – Removal
  – Addition
Patterning by removal

• UV masks can be used to pattern substrates.
  1) Make uniform monolayer
  2) Expose
  3) Backfill with other chemistry of interest

Can test efficiency of SAM removal by doing a blanket exposure.
Patterning by removal

- PDMS masks with air plasma.
  1) Make uniform monolayer
  2) Expose
  3) Backfill with other chemistry of interest

Regions to be removed must be open on at least one end.
Patterning by removal

• Parylene coating leaves no residue behind after liftoff, so can be used as a mask.
  1) Deposit parylene pattern on gold
  2) Make first modification
  3) Remove parylene layer
  4) Backfill
Patterning by addition

• Dip Pen Nanolithography:
  1) Thiols dried onto AFM tip diffuse onto surface when tip is in contact.
  2) Backfill

Good for small patterns, slow for dense features
Patterning by addition

- Soft Lithography
  1) Coat PDMS with thiol solution, let dry
  2) Apply to gold surface
  3) Backfill
Soft Lithography

• PDMS stamps are made from a Si master.
  – Can use etched Si or photoresist patterns
  – We won’t make these masters today, but if you’re interested we cover it in the microfluidics minicourse.

• Master is coated with Sigmacote or fluorinated silane, PDMS is poured over and cured.

• Stamps are cut away from wafer.
Some other considerations

• Limitations of scale
  – We require use of more advanced tools than hands for features smaller than ~50 microns.
  – Feature collapse with very deep features, or those smaller than a few microns
    • ”hard” PDMS

• Stamping works best for monolayers with relatively fast adsorption kinetics.