

## 609e Non-Lithographic Micropatterning of Thin Crystal Film Layers and Bulk Micro-Machining Via Hydrogel Stamping

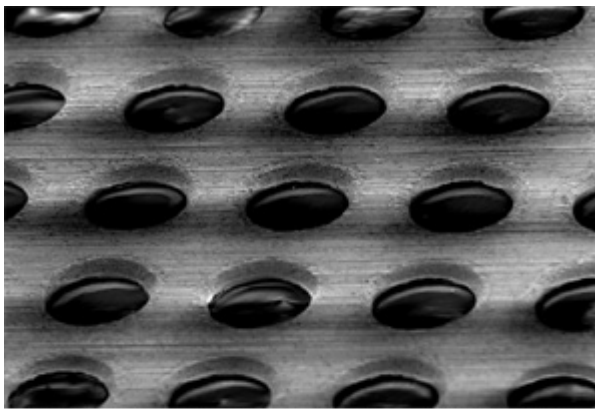
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Wet Stamping (WETS) and Anisotropic Solid Microetching (ASOMIC) - two methods we have developed - use hydrogel stamps patterned in bas relief and soaked in a solution of a desired reagent(s) to **deliver this reagent(s) onto, and remove products from** a solid or a gel substrate. ASOMIC is a **1-step alternative** to traditional lithographic patterning procedures (involving **5 or more steps**) used for creating devices of various functional thin metal, metal oxide, and crystalline semiconducting films. Deep bulk etching of glass and metals produces microlens arrays, micromolding, and microfluidics applications.

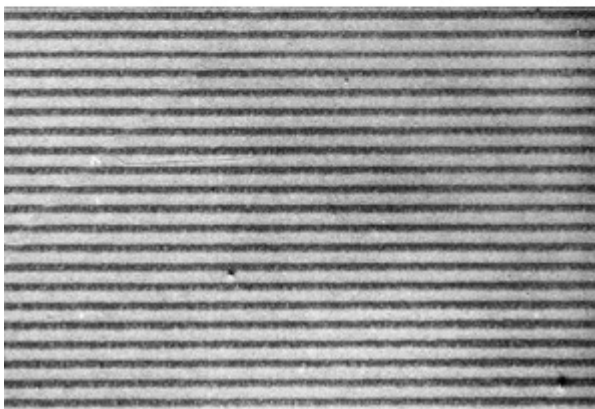
ASOMIC and the more general WETS method overcome many limitations of soft-lithographic techniques, e.g. reagents can penetrate into and modify the bulk of the substrate. Control over reaction geometries and fluxes allows patterning on the micrometer and even hundreds of nanometers scales to produce diffraction gratings, optical elements and microfluidic devices.

Several applications in deep etching of materials, doping and reactive patterning will be discussed in detail. 1-step etching of functional device prototypes is will also be highlighted.

Picture: **Top**: an SEM image of a 40  $\mu\text{m}$  Cu film etched through to give a metal membrane/sieve structure. 3D reliefs are possible with multiple stamping. The same technique can also cut out micro-objects from the foil like a cookie-cutter. **Bottom**: SEM of 140 nm thick, 10  $\mu\text{m}$  wide ZnO wires (piezoelectric material), etched in a single 30-second step.



Cu mesh (150 $\mu\text{m}$  holes in 40 $\mu\text{m}$  film)



ZnO crystal wires on sapphire (10 $\mu\text{m}$ )