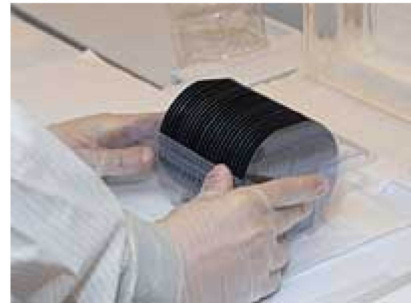
Procedure for Photolithography

Silicon wafers are delivered in plastic containers and before using them in the clean room they have to be thoroughly cleaned.



The cleaning procedure uses a mixture of sulfuric acid and hydrogen peroxide to remove any organic contaminants and particles on the surface of the silicon wafers. The use of strong acids requires special safety procedures and equipment. A vinyl apron, face shield and chemical resistant gloves are required.

Wafers are loaded in a Teflon tray and placed in the special fused silica container to which the sulfuric acid and peroxide are added. The process is exothermic and can generate large amounts of heat and vapors.

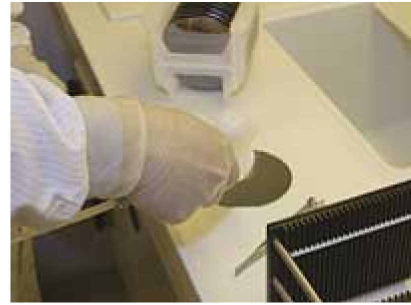
In order to minimize the risks for accidental exposure, the procedure is performed inside a chemical hood and a fused silica lid with a distillation column is used to close the acid bath.

After 20 minutes the acid solution is aspirated

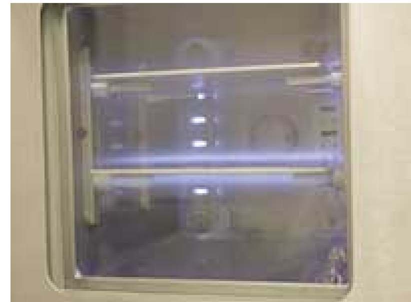
and wafers moved to a distilled water washing bath. After washing, wafers are dried one by one using the nitrogen gun

and then loaded in a metal tray.

In the final step, cleaned wafers are dehydrated in the 200ºC oven for at least 30 minutes.



Several photoresists are available for microfluidic applications. One of the most used is SU8 (http://www.microchem.com/products/su_eight.htm), which is an epoxy based negative resist. Before starting the SU8 photo-patterning procedure an additional cleaning step is performed using oxygen plasma. This step is critical for assuring good adhesion of the photopolymer to the silicon wafer surface.



The desired thickness of the SU8 photoresist is achieved by the control of spinning velocity in a spinner.

The wafer is carefully centered on the spinner chuck

and then a small amount of photoresist poured on the silicon wafer.

After spinning the resist will be spread uniformly on the surface of the silicon wafer.

A pre-bake step is used to harden the SU8 resist before exposure. For this, the wafer is moved from the spinner, using vacuum tweezers,

to the hotplates. The heating steps are performed according to the manufacturer instructions and depending on the thickness of the photoresist coating.

The patterning of the photoresist is performed using ultraviolet light in a mask aligner. The wafer is placed on a vacuum chuck

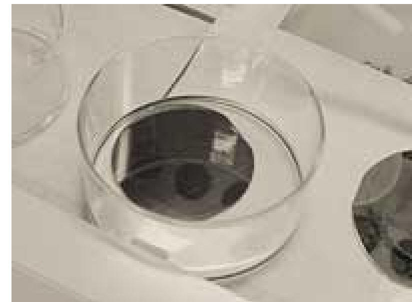
and loaded into the mask aligner.

Inside the mask aligner, the wafer is brought into contact with a mask and the pattern from the mask is replicated into the photoresist by ultraviolet illumination (UV).

After a brief post-bake step, the exposed photoresist is finally developed. The developing process takes place inside the solvent hood.

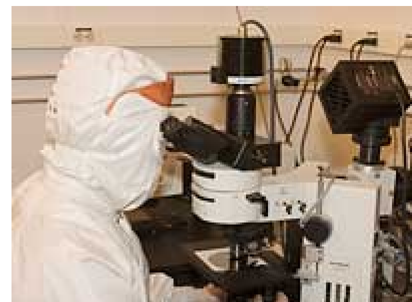
After developing

the wafer is washed with isopropanol



and dried.

The patterned features can be verified using a microscope,

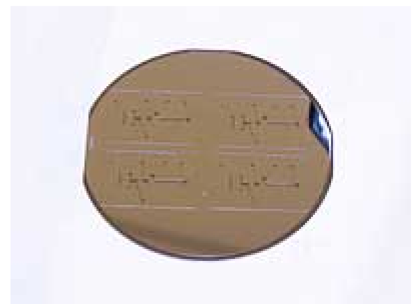


or a profilometer,

or both.

An additional flood exposure of the wafer to UV light can be optionally used to harden the photoresist and improve the mechanical strength of the pattern.

The SU8 patterned wafer is now ready to be used as a mold for PDMS

.