
Fundamentals of Microfluidics and Lab on a Chip **for Biological Analysis and Discovery 1st Edition Li** **Solutions Manual**

2 Micromachining

1. Glass substrates commonly used for chip making are (a) soda-lime, (b) borosilicate and (c) fused silica or quartz.

The process of photolithography starts with the generation of a photomask which is produced by laser or e-beam ablation. Then, a glass substrate which is coated with Cr/Au metals and with photoresist is exposed to UV radiation through the photomask. The substrate is then developed to expose the Au/Cr etch mask, which is in turn developed to expose the glass. This is etched to produce glass channels. Finally, all the remaining photoresist and metals are removed to leave only glass on surface.

2. An etch mask is formed on top of the glass substrate to protect the area that is not intended for etching; whereas a photomask is placed on top of the etch mask to transfer the pattern on it by UV exposure.

3. Both positive and negative photoresists are used to transfer the pattern for etching onto a substrate by photolithography. For positive resists, exposure to UV light weakens the chemical structure of the resist so that it becomes more soluble in, and is washed away by, the developer solution. The photomask, therefore, contains an exact copy of the pattern which is to be fabricated on the substrate.

Negative resists behave in just the opposite manner. Exposure to the UV light causes the negative resist to become polymerized, and thus more difficult to dissolve. Therefore, the negative resist remains on the surface wherever it is exposed, and the developer solution removes only the unexposed portions. Photomasks used for negative photoresists, therefore, contain the inverse or photographic "negative" of the pattern to be transferred.

4. The addition of NH_4F is used as an F^- buffering solution to maintain the etch rate of HF.

Without buffering, as HF is consumed, the etch rate would decrease. But with buffering of F^- from NH_4F , the etch rate will become more uniform.

5. Deep-glass etching increases the channel depth, and hence the optical pathlength in absorbance or fluorescence detection is enhanced. This is useful in enhancing the optical signals, and so the optical detection sensitivity is increased.

6. RIE (reactive ion etching) is a method used to perform anisotropic etching of Si. Reactive gas species, such CF_4 or SF_6 , are used to produce a plasma in the etch chamber. In this dry etch process, charged gaseous species formed in the plasma react with the surface Si atoms. The product species then leave the surface thermally, if the vapour pressure is high enough, or as a result of ion bombardment.

Biological Patterns Lab Manual Answers

Michael Brown



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