dimensions **44** to the substrate **42**. One example etching process is isotropic reactive ion etching. For instance, as shown in the middle progression of FIG. **2**, an etchant initially removes the thinnest portion of the photoresist **40** to expose the underlying substrate **42**. Once exposed, the etchant also removes the substrate **42** and continues to remove the thicker portions of the photoresist **40** to expose additional substrate **42** area. Thus, the etchant cuts deeper into the initially exposed area of the substrate **42** than the area that is last exposed to thereby transfer the plurality of nanoscale critical dimensions **44** into the substrate **42**, as in the bottom progression. As an example, the etching may be ceased shortly after the etchant removes the last step of the plurality of nanoscale critical dimensions **44**. The etching duration is selected such that the thickest portions may not be completely removed.

[0023] The etching is controlled to effect transfer of the nanoscale critical dimensions **44** in the patterned topography **41** of the photoresist **40** into the substrate **42**. As an example, the etchant may be an etchant gas mixture that is designed to selectively etch the photoresist and the substrate **42**. In comparison, the typical desire in traditional photolithograpy is to limit the etching of the photoresist (e.g.; high selectivity) in order to protect the substrate from exposure. However, the etchant gas mixture of the nanofabrication process **20** may be a relatively low selectivity, multi-component mixture for etching the photoresist **40** and the substrate **42**. For instance, the etchant gas mixture may include a first etchant primarily for etching the photoresist **40** and a second etchant primarily for etching the substrate **42**. In one example, the etchant gas mixture may include oxygen gas and a fluorinated gas, such as trifluoromethane gas. The oxygen generally etches the photoresist **40**, while the fluorinated gas etches the substrate **42**.

[0024] A user may control the amount of the oxygen gas in the etchant gas mixture to establish a desirable etching ratio between the substrate **42** and the photoresist **40** to transfer a patterned topography having a plurality of nanoscale critical dimensions **44** in the photoresist **40**. The patterned topography transfers as a corresponding patterned topography having a plurality of nanoscale critical dimensions **44*b*** in the substrate **42**. For instance, the corresponding patterned topography having a plurality of nanoscale critical dimensions **44*b*** in the substrate **42** may be a down-scaled transfer of the patterned topography of plurality of nanoscale critical dimensions **44** in the photoresist **40**. The amount of oxygen in the etchant gas mixture is controlled to establish an etching selectivity of about 0.35-0.65. The etching selectivity is a ratio of an etching removal rate of the substrate **42** to an etching removal rate of the photoresist **40**. The flow rate of oxygen gas may be controlled to achieve desired etching rates and selectivities. In one example, the flow rate of the oxygen gas may be about 10-25 standard cubic centimeters per minute, while the flow rate of the fluorinated gas may be around 50 standard cubic centimeters per minute with an overall pressure of about 60 milliTorr. Given this description, one of ordinary skill in the art will be able to recognize other flow rates to suit their particular needs.

[0025] In the example of FIG. **2**, the etching creates an elongated channel **49** (e.g., extending perpendicular with regard to FIG. **2**) in the substrate **42**, with the plurality of nanoscale critical dimensions **44*b*** arranged as a stepped gradient across the width of the elongated channel **49**. For instance, each step of the stepped gradient may have a nanoscale depth with regard to the surface (as represented by the dashed line) of the substrate **42** and/or a nanoscale step size. The stepped gradient spans across the width of the channel **49**, which may be of a macroscale dimension. As an example, a macroscale may be a dimension larger than nanoscale, such as microscale, milliscale or larger. In this respect, the etching can be controlled to produce desired nanoscale critical dimensions of the steps. As an example, the steps may include a depth range and/or step size across several scales from 10 nanometers to 0.6 micrometers.

[0026] In the illustrated example, the steps are generally perpendicular, however, in other examples the corners of the steps may be angled non-perpendicularly. In other examples, the gradient may extend lengthwise along the elongated channel rather than across the width. As shown, the elongated channel includes about seven steps. However, in other examples, the nanofabrication process may be used to form smaller, more discrete steps of the stepped gradient, or even a smooth slope. For instance, in some examples, a stepped gradient may include hundreds of steps or even more than 1,000 steps. Additionally, some examples may have a geometry containing no multiply etched regions between adjacent disparate depths, which can result from two or more iterations of traditional photolithography.

[0027] Different etching selectivities and durations may be used to fabricate nanostructures with different depth profiles and depth offsets from a single photomask. As an example, a less selective etch within the above-given range may be used to make a “shallow” stepped structure with a step size of about 11 nanometers, no depth offset, and depths controlled from 11±4 nanometers to 332±4 nanometers (mean±standard deviation) across a 120 micrometer width of a channel. A more selective etch may be used to make a “deep” stepped structure with a step size of about 19 nanometers, a depth offset of approximately two-and-a-half steps, and depths controlled from 64±4 nanometers to 624±5 nanometers across a 120 micrometer channel width. The measurements may be made using a scanned probe surface profilometer. The less selective and more selective etches may result in a root mean square surface roughness value of about 3 nanometers and 2 nanometers, respectively.

[0028] In use, a cover may be provided over or around the channel **49** such that the channel **49** includes an inlet or inlets at one end and an outlet or outlets at the other end for transporting a material to be analyzed. The nanodevice may also include other structures or components that function in cooperation with the channel **49** for the purpose of facilitating movement of the material through the channel or analyzing the material.

[0029] FIG. **3** illustrates one implementation of the elongated channel **49**. In this example, the elongated channel **49** is included within a nanofluidic device **50**. The elongated channel **49** includes an inlet **52** at one end and an outlet **54** at the other end.

[0030] The nanodevice **50** further includes first and second voltage control channels **56*a*** and **56*b*** arranged with the channel **49** therebetween. Lateral channels **58** extend between the voltage control channels **56*a*** and **56*b*** and through the channel **49**.

[0031] In use, conductive fluids flowing through the voltage control channels **56*a*** and **56*b*** facilitate generating an electric field **60** across the channel **49**. As an example, the voltage in the second voltage control channel **56*b*** may be greater than the voltage in the first voltage control channel **56*a***. The applied voltages cooperate with the lateral channels **58** to