CLAIMS

What is claimed is:

1. A method for fabricating a single nanopore in a membrane, comprising:

selecting an electric potential that induces an electric field that approaches dielectric strength in the membrane, where the electric field has a value greater than 0.1 volt per nanometer;

applying the electric potential across a membrane comprised of a dielectric material;

monitoring leakage current across the membrane while the electric potential is being applied across the membrane;

detecting an abrupt increase in the leakage current across the membrane while the electric potential is being applied across the membrane; and

removing the electric potential across the membrane in response to detecting the abrupt increase in the leakage current to stop the pore fabrication.

2. The method of claim 1 wherein selecting the electric potential further comprises selecting ~~an~~ the electric potential that approaches dielectric strength of the membrane material.

3. The method of claim 1 wherein detecting an abrupt increase in the leakage current further comprises determining a rate of change of the monitored current and comparing the rate of change to a threshold.

4. The method of claim 3 wherein removing the electric potential across the membrane further comprises removing the electric potential when the rate of change of the monitored current exceeds the threshold, thereby stopping the fabrication.

5. The method of claim 1 wherein detecting an abrupt increase in the leakage current further comprises comparing a value of the monitoring current to a threshold and removing the electric potential when the value of the monitoring current exceeds a threshold, thereby stopping the fabrication.

6. The method of claim 1 wherein applying the electric potential further comprises

disposing the membrane between two reservoirs filled with a fluid containing ions, such that the membrane separates the two reservoirs and prevents the fluid from passing between the two reservoirs;

placing an electrode into each of the two reservoirs; and

generating the electric potential using the electrodes.

7. The method of claim 6 wherein placing the electrode further comprises placing one of the two electrodes into direct contact with the membrane.

8. The method of claim 1 wherein applying the electric potential further comprises increasing the applied electric potential to reduce fabrication time.

9. The method of claim 1 wherein applying the electric potential further comprises increasing the electric field in the membrane to reduce fabrication time.

10. The method of claim 6 further comprises increasing concentration of ions in the fluid to reduce fabrication time while applying the electric potential.

11. The method of claim 6 further comprises increasing acidity of the fluid to reduce fabrication time while applying the electric potential.

12. The method of claim 6 further comprises increasing alkalinity of the fluid to reduce fabrication time while applying the electric potential.

13. The method of claim 6 further comprises changing acidity of the fluid in one reservoir in relation to the fluid in the other reservoir to change fabrication time while applying the electric potential.

14. The method of claim 6 further comprises adjusting acidity of the fluid on each side of the membrane to control geometry and surface charge characteristic of the pore while applying the electric potential.

15. The method of claim 6 further comprises adjusting polarity of the electric potential in the membrane to control geometry and surface charge characteristic of the pore while applying the electric potential.

~~16. A method for fabricating a single nanopore, comprising:~~

~~disposing a membrane comprised of a dielectric material between two reservoirs filled with a fluid, such that the membrane separates the two reservoirs and prevents the fluid from passing between the two reservoirs;~~

~~applying an electric potential across the membrane, where value of the electric potential is selected to induce an electric field which causes a leakage current across the membrane ;~~

~~monitoring the induced leakage current between the two reservoirs while the electric potential is being applied;~~

~~determining a rate of change of the monitored current;~~

~~comparing the rate of change of the monitored current to a threshold; and~~

~~ceasing to apply the electric potential when the rate of change of the monitored current exceeds the threshold, thereby stopping fabrication.~~

~~17. The method of claim 16 further comprises selecting an electric potential that induces an electric field having a value greater than 0.1 volts per nanometer.~~

~~18. The method of claim 16 further comprises selecting an electric potential that induces an electric field having a value in a range of 0.1 to 1.0 volts per nanometer.~~

~~19. The method of claim 16 wherein the fluid is defined as ions dissolved in an aqueous solvent.~~

~~20. The method of claim 16 wherein the fluid is defined as ions dissolved in an organic solvent.~~

~~21. The method of claim 16 wherein the fluid does not need to have a specific chemical etching action towards the membrane.~~

~~22. The method of claim 16 further comprises controlling location of pore formed in the membrane by localizing the electric field strength or dielectric strength proximate a desired location for the pore.~~

~~23. The method of claim 16 further comprises controlling location of pore formed in the membrane by reducing thickness of the membrane in area of a desired location for the pore.~~

~~24. The method of claim 16 further comprises controlling rectification of the pore formed in the membrane based on acidity and conductivity of the fluid.~~

~~25. An apparatus for fabricating a single nanopore in a membrane, comprising:~~

~~two reservoirs fluidly coupled via a passageway to each other, wherein the passageway is configured to receive a membrane that prevents liquid from passing between the two reservoirs, where the membrane is comprised of a dielectric material;~~

~~at least two electrodes electrically connected to a voltage source and operable to generate an electric potential across the membrane, where~~

~~one electrode of the at least two electrodes is disposed in each of the two reservoirs;~~

~~a current sensor electrically coupled to one of the electrodes and operable to measure current flowing between the two reservoirs; and~~

~~a controller interfaced with the current sensor, wherein the controller detects an abrupt increase in the measured current and, in response to detecting the abrupt increase in the measured current, remove the electric potential across the membrane.~~

~~26. The apparatus of claim 25 wherein one of the reservoirs is fluidly separated in two or more micro- or nano- channels, each micro- or nano-channel having an electrode disposed therein.~~