Theoretical modeling of dendrite growth from conductive wire electro-polymerization

Ankush Kumar\textsuperscript{1*}, Kamila Janzakova\textsuperscript{1}, Yannick Coffinier\textsuperscript{1}, Sébastien Pecqueur\textsuperscript{1}, Fabien Alibart\textsuperscript{1,2}

1 Univ. Lille, CNRS, Centrale Lille, Univ. Polytechnique Hauts-de-France, UMR 8520 - IEMN, F59000 Lille, France.

2 Laboratoire Nanotechnologies & Nanosystèmes (LN2), CNRS, Université de Sherbrooke, J1X0A5, Sherbrooke, Canada.

\textsuperscript{*}ankush.kumar@iemn.fr, ankush.science@gmail.com
A 150 x 150 pixels image screen is created.

Bipolar electrodes of width 5 pixels are created in the center at a separation of 20 pixels.

Periodic signal is applied on the electrodes with certain Amplitude, frequency, duty cycle and offset.

Potential map is evaluated in the complete screen using Laplace equation.

N Particles are generated in the center of the screen (100 x 100).

Particles can move in any neighborhood eight directions, based on potential (V) and noise(η), drift along all possible direction is calculated as \( \frac{dV}{dr} + \eta \).

The selected direction \( r \) of motion possesses maximum \( \max \left( \frac{dV}{dr} + \eta \right) \).

The probability of motion is \( p = \frac{1}{\alpha} \frac{\max \left[ \frac{dV}{dr} + \eta \right]}{\text{Mean} \left[ \frac{dV}{dr} + \eta \right]} \).

Potential on double layer is calculated for applied signal.

Particle can stick to electrode if spacing is < 2 pixels.
Sticking probability is defined as sigmoidal function.

Dendrite structure grows on the electrode.

Figure S1: Simulation steps for modeling of dendrite growth from conductive wire electro-polymerization