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Electronic Supporting Information for

Leveraging electrokinetics for the active control of dendritic fullerene-1 release across a nanochannel membrane

Giacomo Bruno[1,2,*], Thomas Geninatti[1,3,*], Robert L. Hood[1], Daniel Fine[1], Jeffrey Schmulen[1], Giovanni Scorrano[1], Sharath Hosali[4], Mauro Ferrari[1], and Alessandro Grattoni[1]

[1]Nanomedicine Department, Houston Methodist Research Institute (HMRI), Houston, TX, U.S.A.

[2]Politecnico di Torino, Turin, Italy

[2]College of Materials Science and Engineering, University of Chinese Academy of Sciences (UCAS), Beijing, China

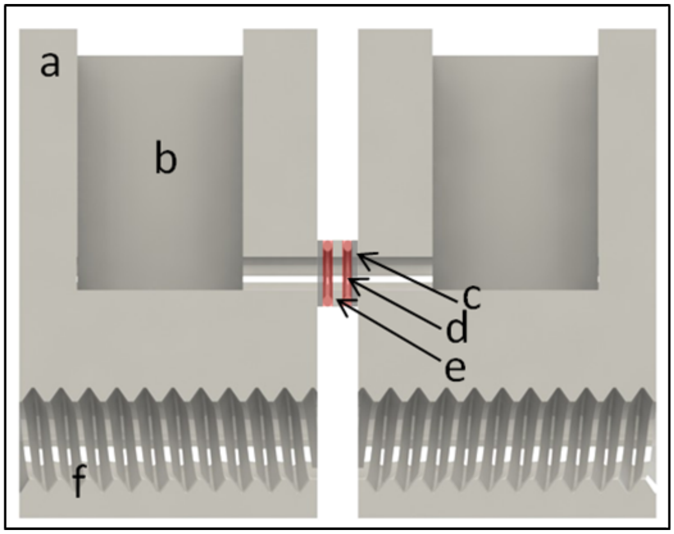
[3]NanoMedical Systems, Inc., Austin, TX, USA

email: agrattoni@houstonmethodist.org

[*]equal contribution

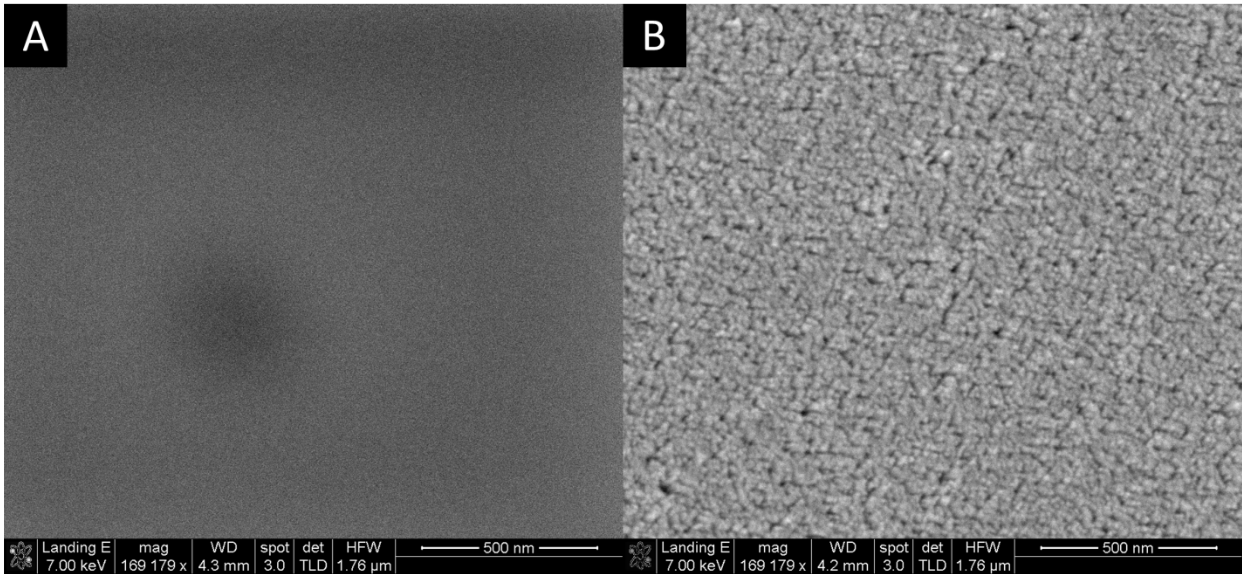
1 Custom device used to perform the electrical.

Supplementary Figure 1 shows the custom device employed to perform the electrical characterization of the 5.7 nm membrane.



Supplementary Figure 1. Custom device used for the electrical characterization composed of: (a) PVC body, (b) 2 ml reservoirs, (c) Pt electrode, (d) silicon rubber O-ring, (e) 5.7 nm membrane, (f) screw thread.

2 Scanning Electron Microscopy (SEM) of the electrode surface.

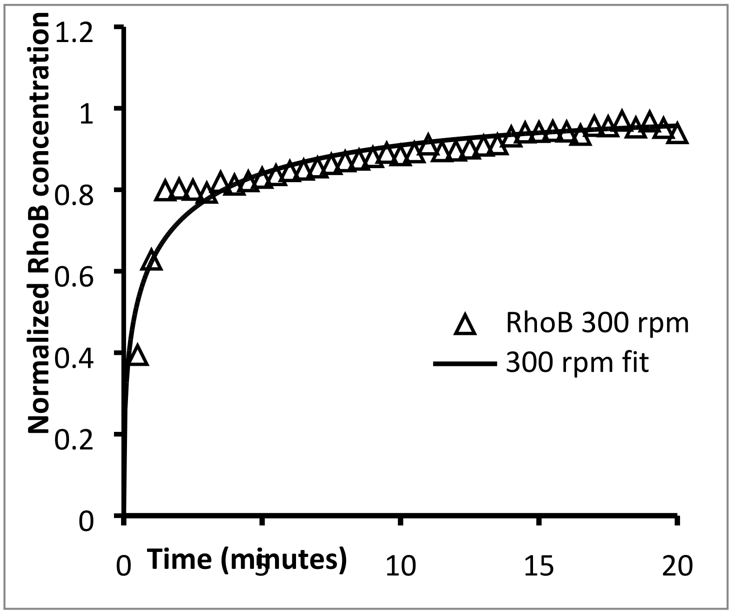


Supplementary Figure 1 shows the smoother surface for a SiN/Ti/Pt electrode deposited at 90° as compared to 15°.

Supplementary Figure 2. SEM micrograph of the surface of deposited electrodes. Surface of SiN/Ti/Pt electrodes deposited at an angle of 90° (A). Surface of SiN/Ti/Pt electrodes deposited at an angle of 15° (B).

3 Sink fluid homogenization test.

Custom diffusion devices were adopted to test the controlled release of DF-1. Such devices used a UV-cuvette as a sink reservoir. The amount of DF-1 released through the membrane was obtained by measuring the UV-absorbance of the sink fluid in the cuvette. The fluid was magentically stirred at a rate of 300 rpm for homogenization. However, after an amount of DF-1 was released at the membrane outlet, a period of time was required to obtain complete homogenization of the sink fluid. In other words, a delay exists from the time in which an amount of DF-1 was released and the time in which the related difference in sink concentration was fully detected. This influences on the time-response of the testing apparatus to the variation of release rate due to an electrical potential applied to the membrane. In order to determine the characteristic delay of the system, a sink fluid homogenization test was performed with rhodamine B (RhoB). Micro-magnetic stir bars (Fisher Scientific Inc., NH, USA) were inserted in standard spectrophotometer cuvettes containing 3 ml of Millipore water and housed in the robotic UV-spectrophotometer/carousel apparatus[1]. Absorbance measurements (λ = 401 nm) were collected every 30 sec for 30 min. After four readings, 30 µl of a RhoB aqueous solution (concentration = 1 mg ml^{-1}) was gently added to the water surface without interrupting the experiment. Homogenization kinetic profiles were obtained with 3 replicate experiments at a stirring speed of 300 rpm. RhoB concentration data were normalized with respect to the final nominal concentration (9.9 µg ml^{-1}). The normalized average results are shown in Supplementary Figure 2. The normalized concentration monotonically tends to unity following the exponential trend $c_N = 1 - e^{-\beta t^{\alpha}}$ where β represents the time constant and α the time exponent, with no fluctuations observed. The time required to achieve 90% homogenization ($t_{90\%}$) at 300 rpm was found to be ~ 24 mins. This would explain the release rate transient experimentally observed during the DF-1 controlled release experiments described in the manuscript.



Supplementary Figure 3. Homogenization test for RhoB in water at 300 rpm. The average measured concentration (n=3) is shown together with an exponential fitting.

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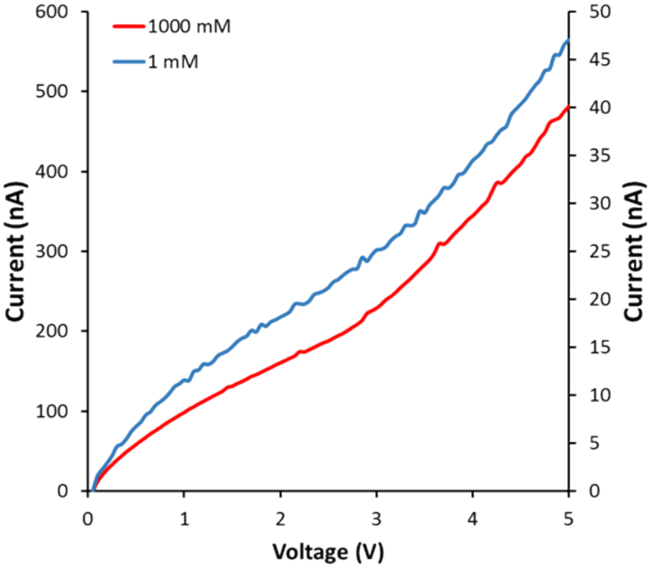
4 IV comparison between low and high concentration

A magnification of the lower concentrations to more clearly show the departure from ohmic behavior for 1 and 1000 mM NaCl concentration is shows in Supplementary Figure 4.



Supplementary Figure 4. Current- voltage (I-V) curves at low (1 mM) and high (1000 mM) NaCl concentration. The left y-axis is for 1000 mM while the right x-axis is for 1 mM.

References

1 T. Geninatti, E. Small, and A. Grattoni, *Measurement Science and Technology* 2014, 25, 027003 (6pp).