



Nanoscale

ARTICLE

Supporting Information

Microneedles Integrated with a Triboelectric Nanogenerator: An Electrically Active Drug Delivery System

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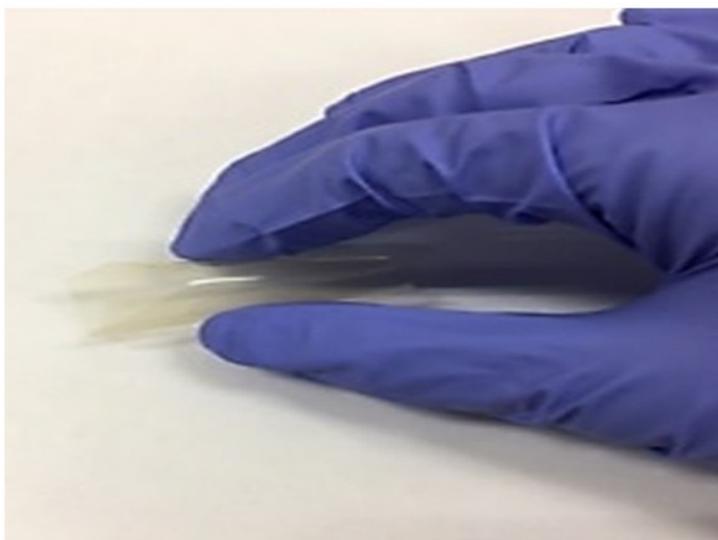


Figure S1. Photograph of the fabricated SDNA film.

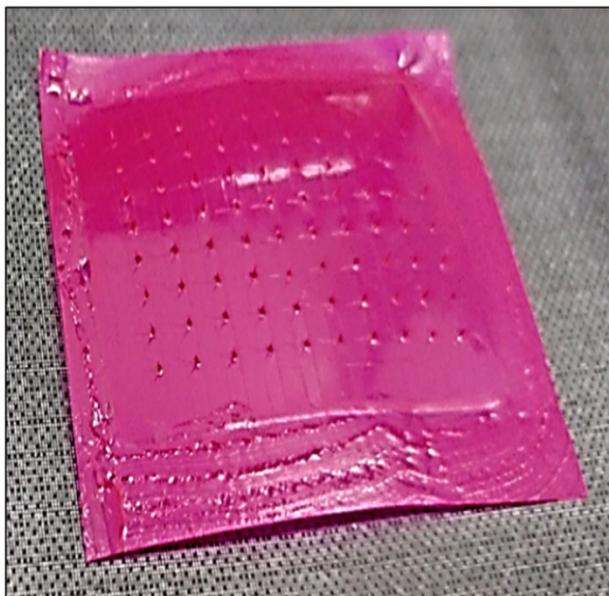


Figure S2. Photograph of a microneedle patch.

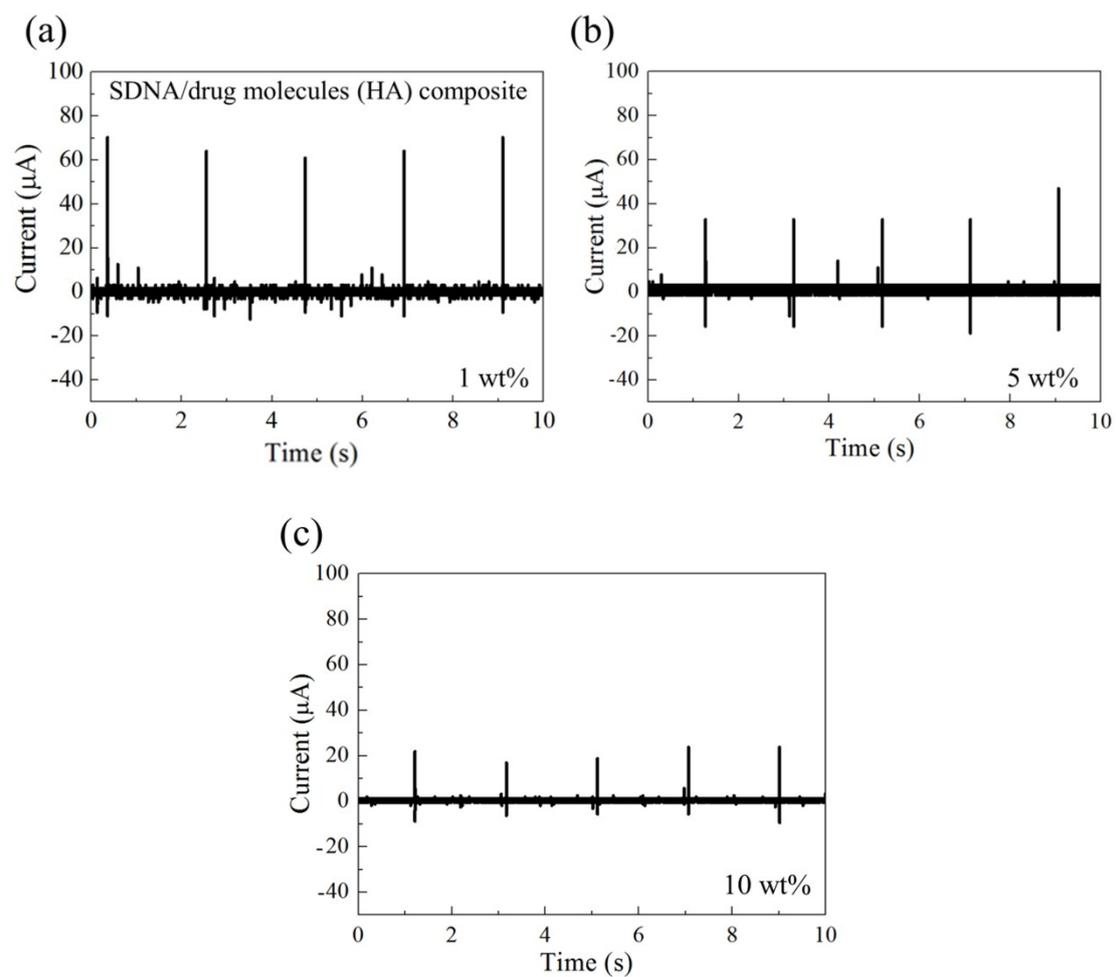


Figure S3. Output current with respect to the concentration of drug molecules in SDNA/Drug molecule composite films: (a) 1, (b) 5, and (c) 10 wt%.

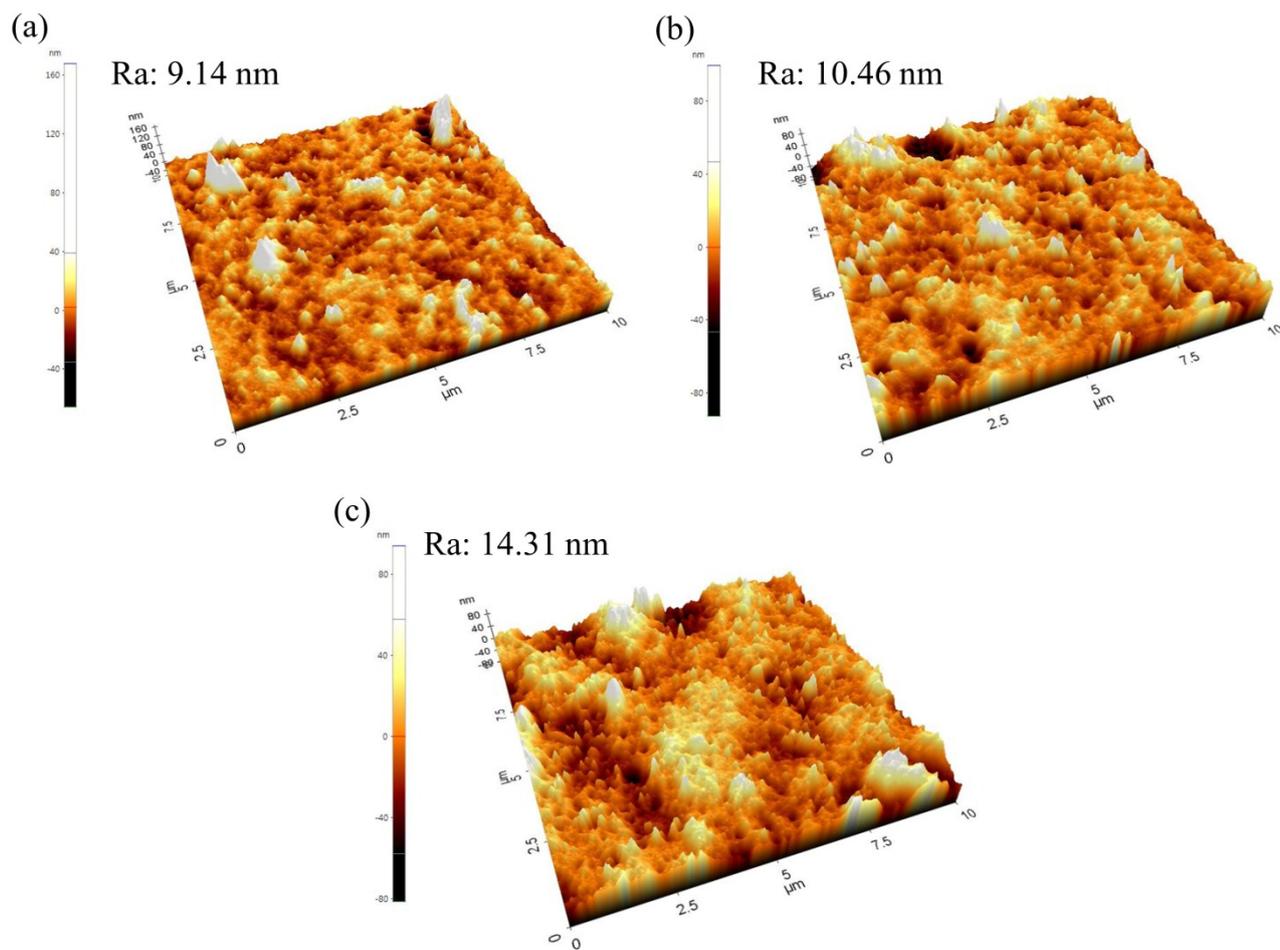
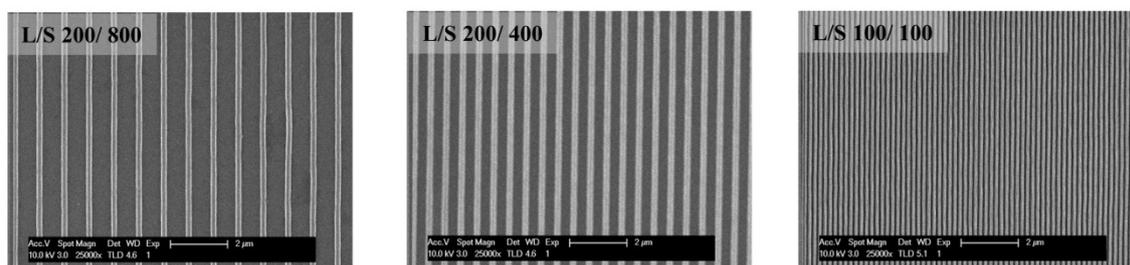


Figure S4. AFM images with respect to the concentration of drug molecules in SDNA/Drug molecule composite films: (a) 1, (b) 5, and (c) 10 wt%. All samples were scanned over a region of $10 \times 10 \mu\text{m}^2$ in size.

(a)



(b)

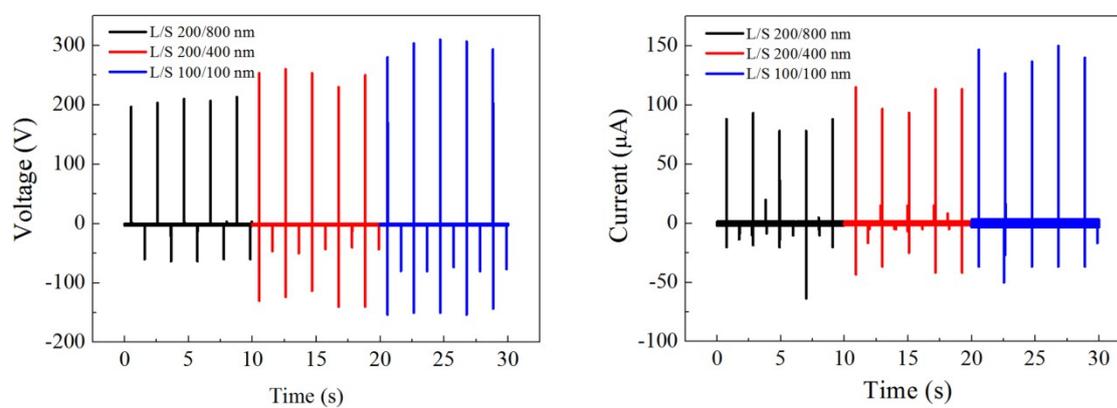


Figure S5. SEM images of patterned SDNA: Line (L)/ Space (S) 200/800 nm, L/S 200/400 nm, L/S 100/100 nm. (b) Output performance with patterned SDNA.

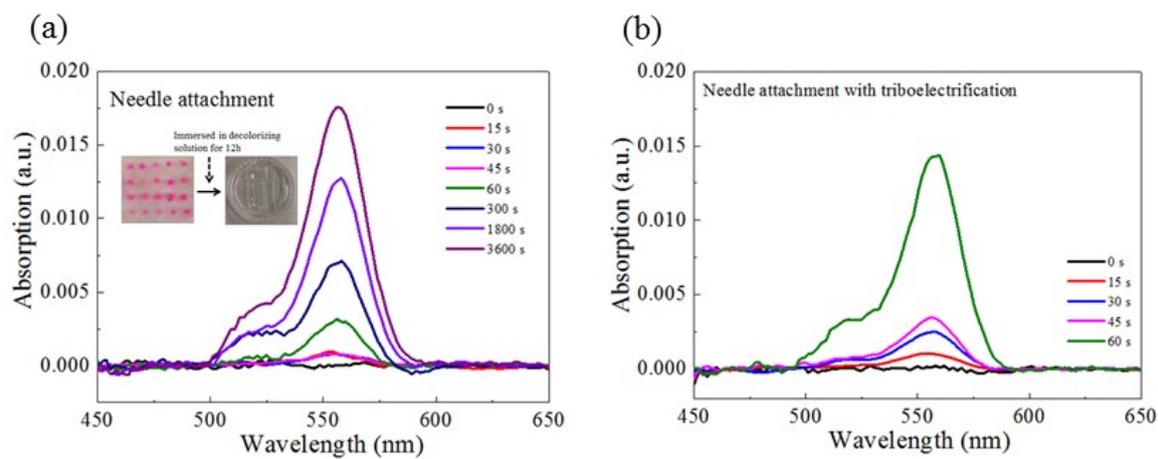


Figure S6. Absorption spectrum over time of (a) needle attachment, (b) needle attachment with triboelectrification. The inset shows the images of drug release into the hydrogel and the decolorized hydrogel after drug release.