Supporting Information for

Surface Modifications of an Organic Polymer-Based Microwire Platform for Sustained Release of an Anti-Inflammatory Drug

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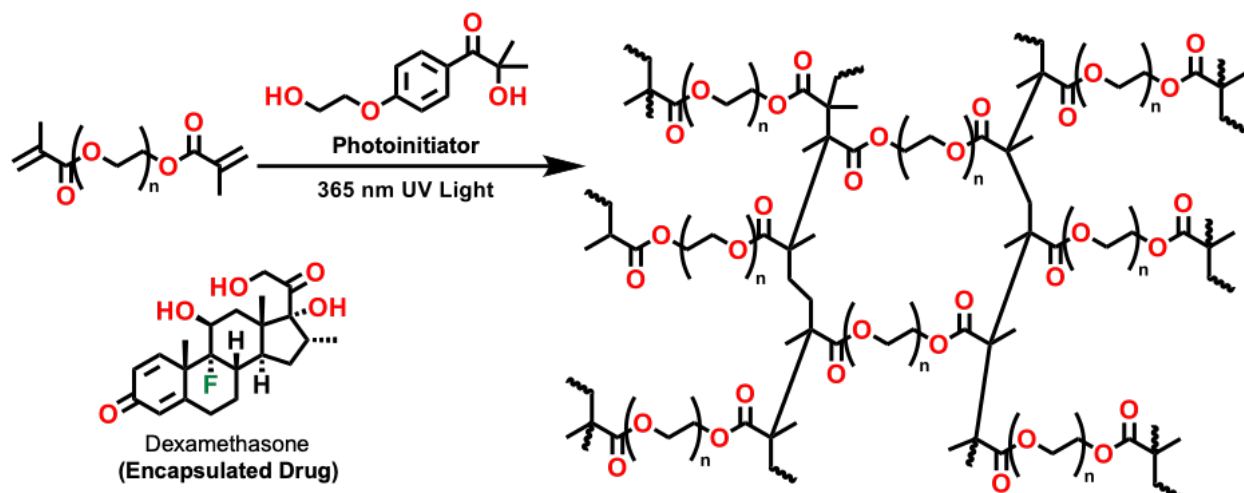
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Table of Contents

1. Synthesis of PEG₃₄₀₀ Hydrogel.

Scheme S1. Reaction scheme for photopolymerization of PEGDMA precursors. Chemical structures of the hydrogel precursor, the photoinitiator, and the drug studied are shown. The 3D polymer network formed is schematized here in a 2D manner.
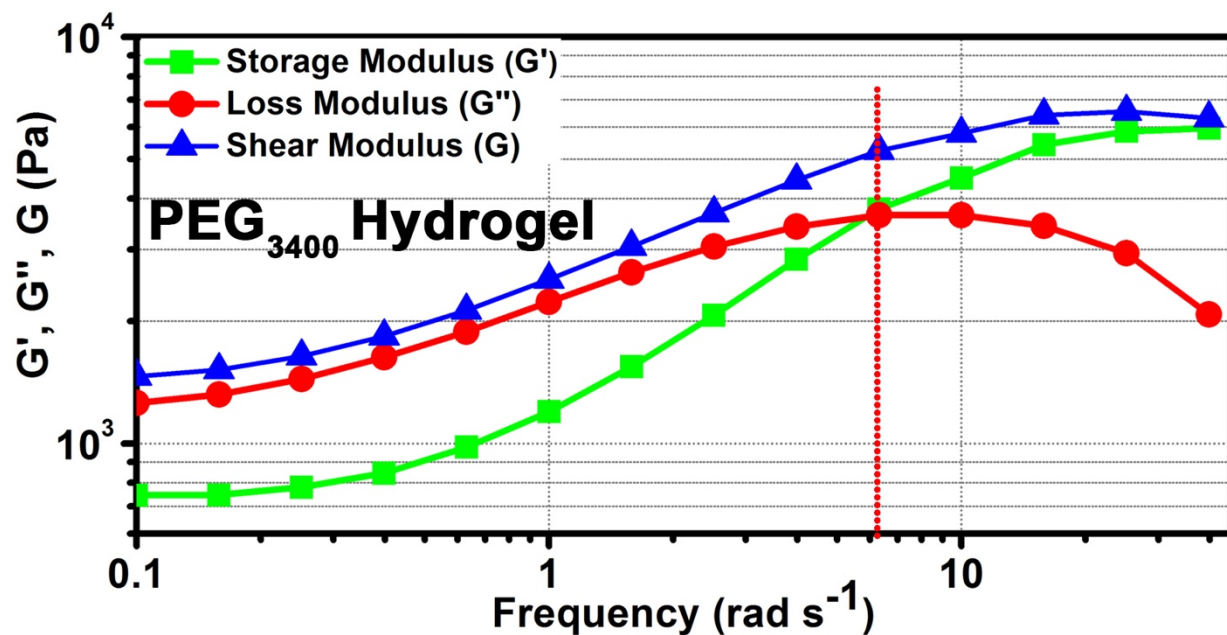
2. Mechanical Properties of PEG$_{3400}$ Hydrogel.

**Figure S1.** Rheology frequency sweep results for **Dex8.9-PEG$_{3400}$** hydrogel block.

The Young modulus is calculated using the following equation:
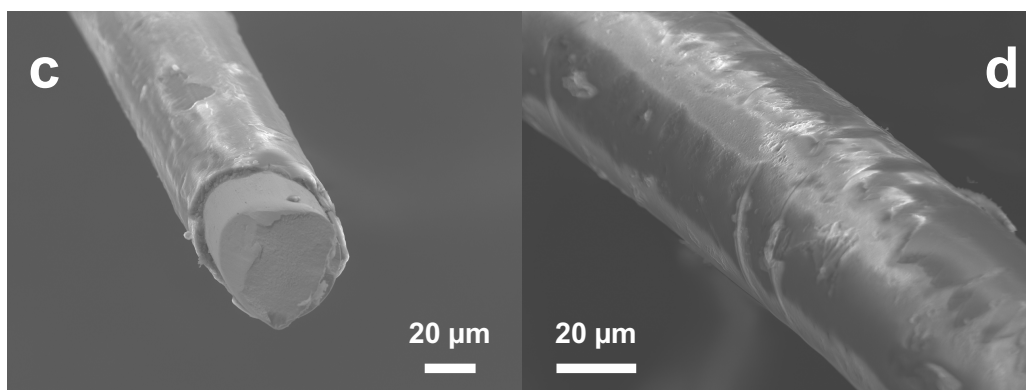
$$E = 2G(1+v) \text{ (eq. S1)}$$

Where E is the Young's modulus, G the shear modulus, and v the Poisson's ratio of the materials. Data were averaged based on three replicates. **Dex8.9-PEG$_{3400}$** hydrogel block is characterized by a Young's modulus of 25.7 kPa.

3. Microscopic Characterization of the Functionalized Wires.

Pt-Ir-COOH
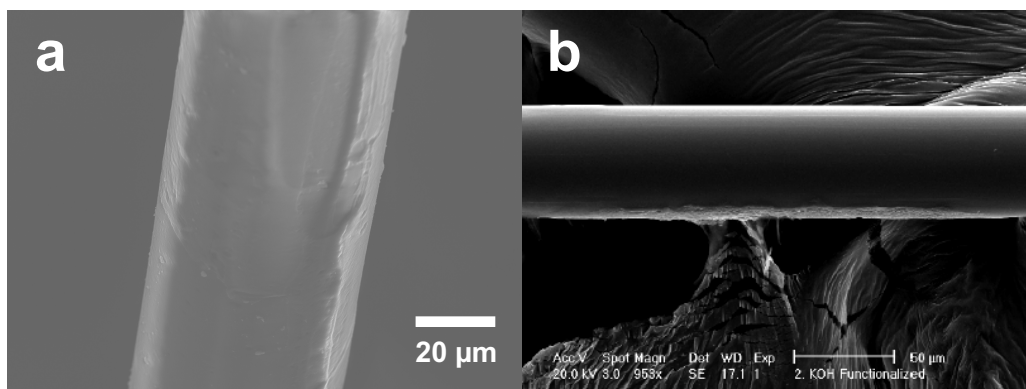
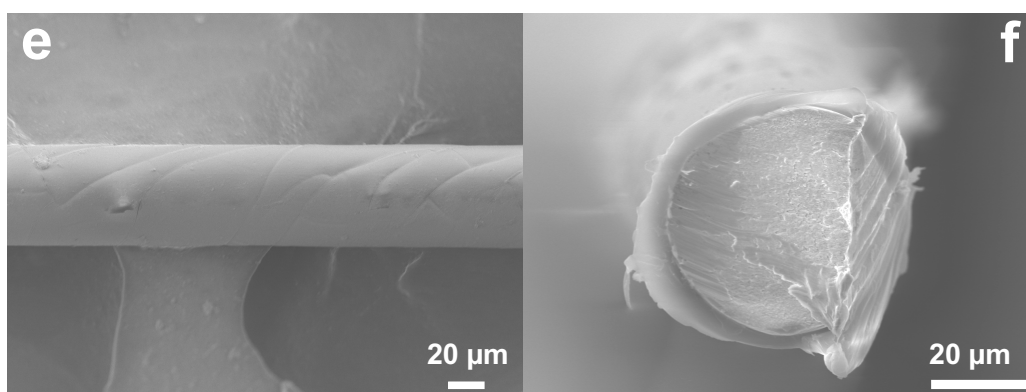# Pt-Ir-OTEG

Pt-Ir-MAC

Figure S2. Additional SEM images of: (a-b) carboxylic acid functionalized microwire (**Pt-Ir-COOH**), (c-d) triethylene glycol functionalized microwire (**Pt-Ir-TOHEG**), and (e-f) methacrylate-functionalized microwire (**Pt-Ir-MAC**).
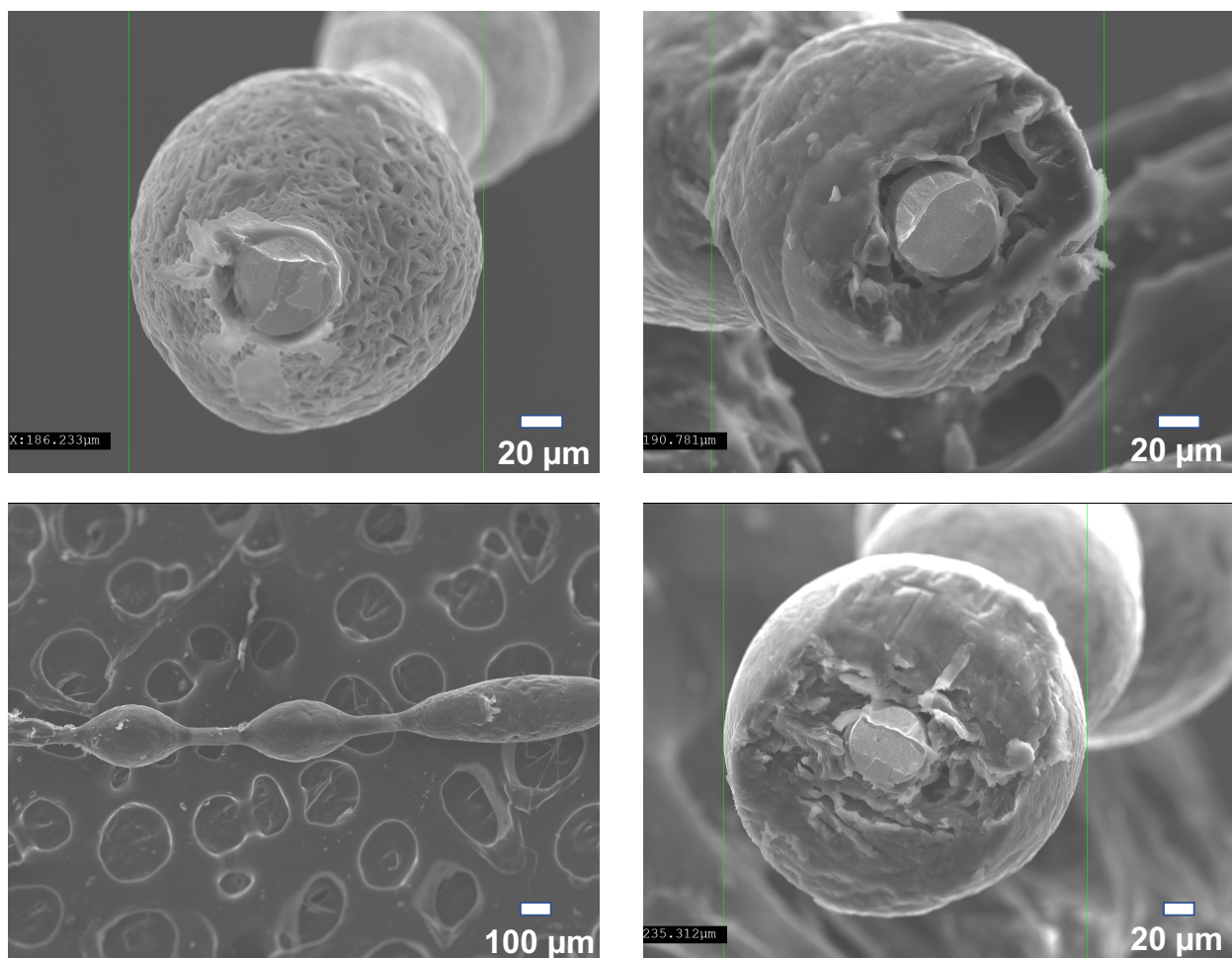
Figure S3. SEM images of dry hydrogel-functionalized microwires fabricated using the painting method and the following hydrogel precursor solution: 8.9% Dex w/w, 50% w/w PEGDMA$_{3400}$, EtOH:PBS 1:1.
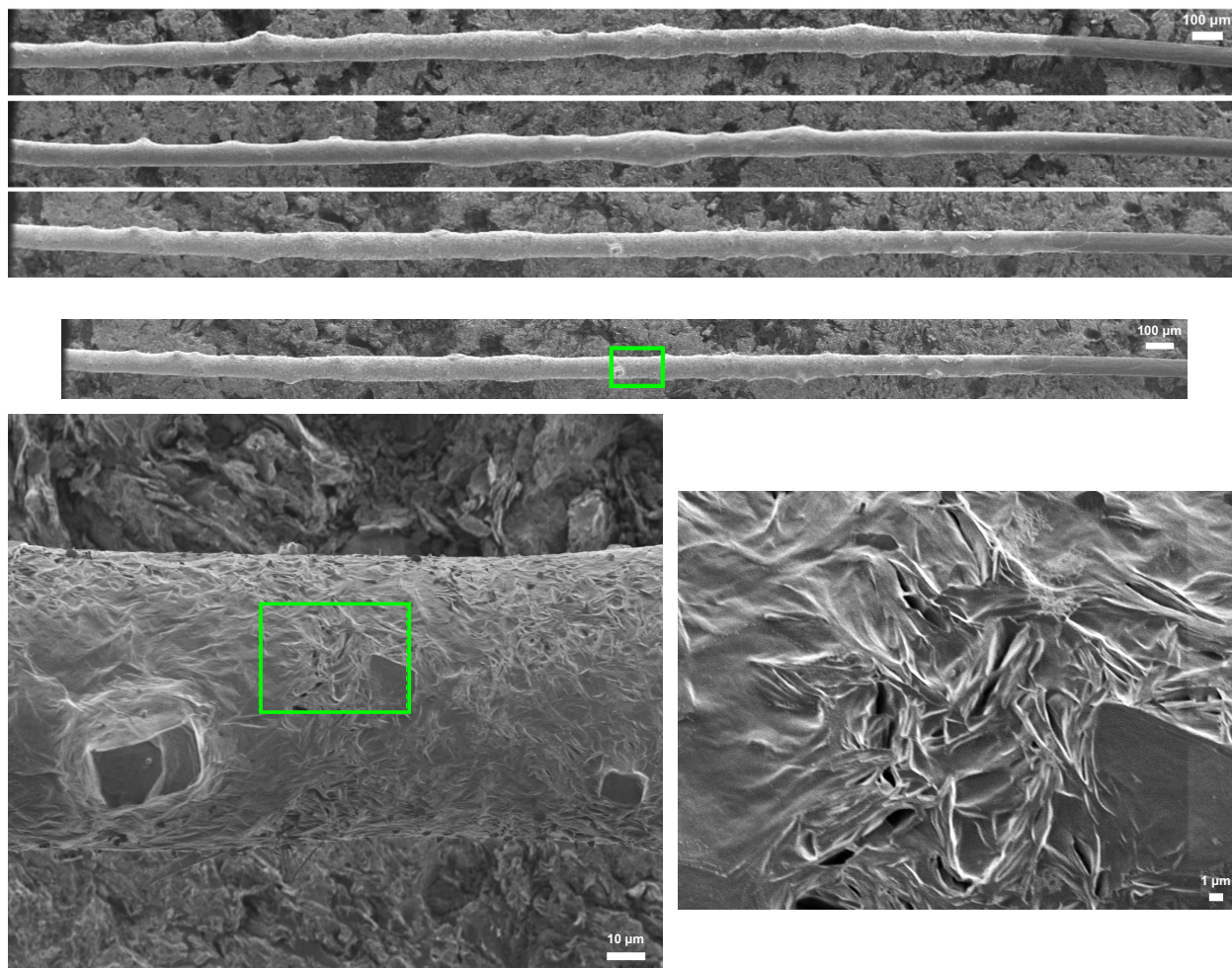
Figure S4. Additional SEM images of functionalized drug-loaded hydrogel microwires **Dex-Pt-Ir-PEG$_{3400}$** fabricated with 50% w/w PEGDMA, 8.9% w/w Dex, and EtOH/PBS (3:1).
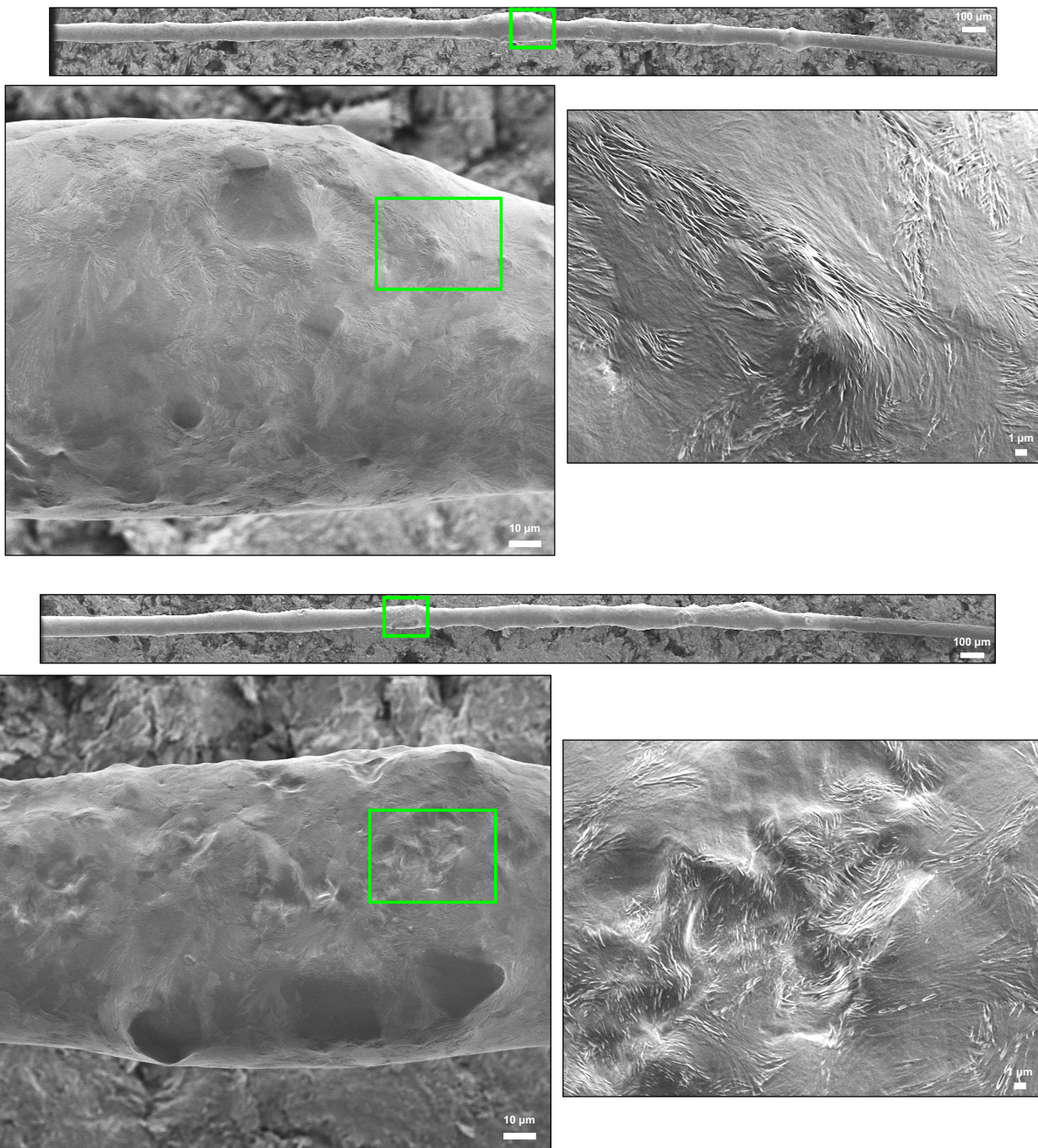
Figure S5. Additional SEM images of functionalized drug-loaded hydrogel microwires **Dex-Pt-Ir-PEG$_{3400}$** fabricated with 50% w/w PEGDMA$_{3400}$, 8.9% w/w Dex, and EtOH/H$_2$O (3:1).
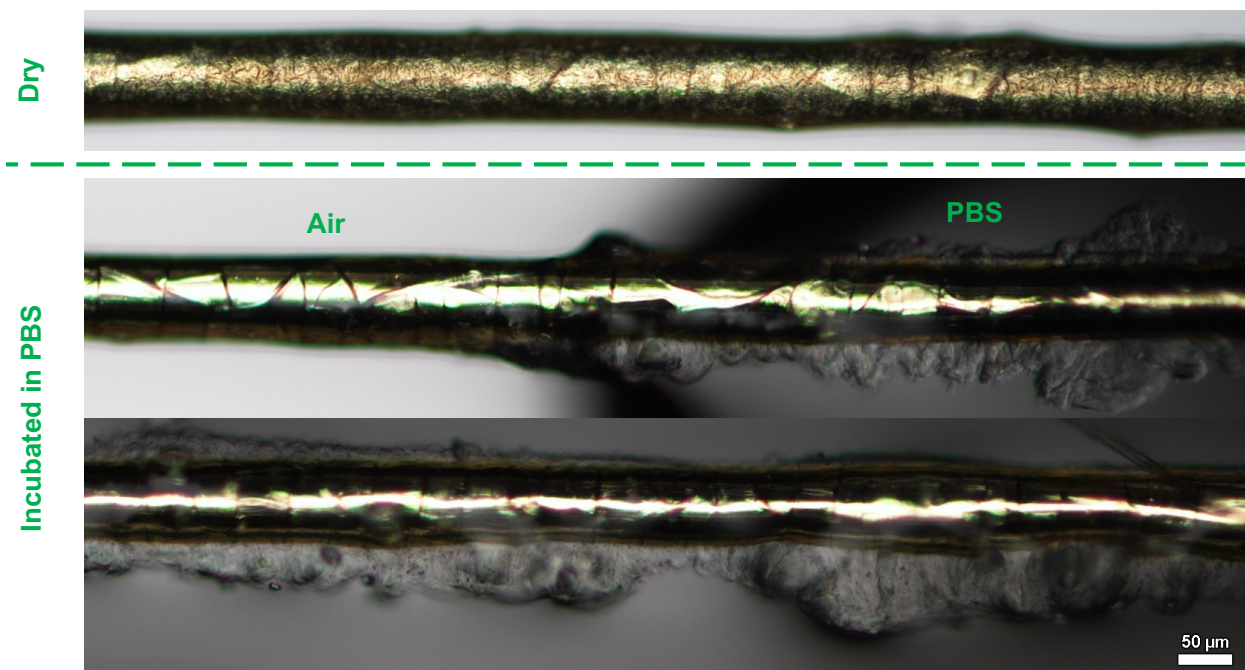
Figure S6. Additional optical microscopy images of functionalized drug-loaded hydrogel microwires **Dex-Pt-Ir-PEG$_{3400}$** fabricated with 50% w/w PEGDMA$_{3400}$, 8.9% w/w Dex, and EtOH/H$_2$O (3:1).
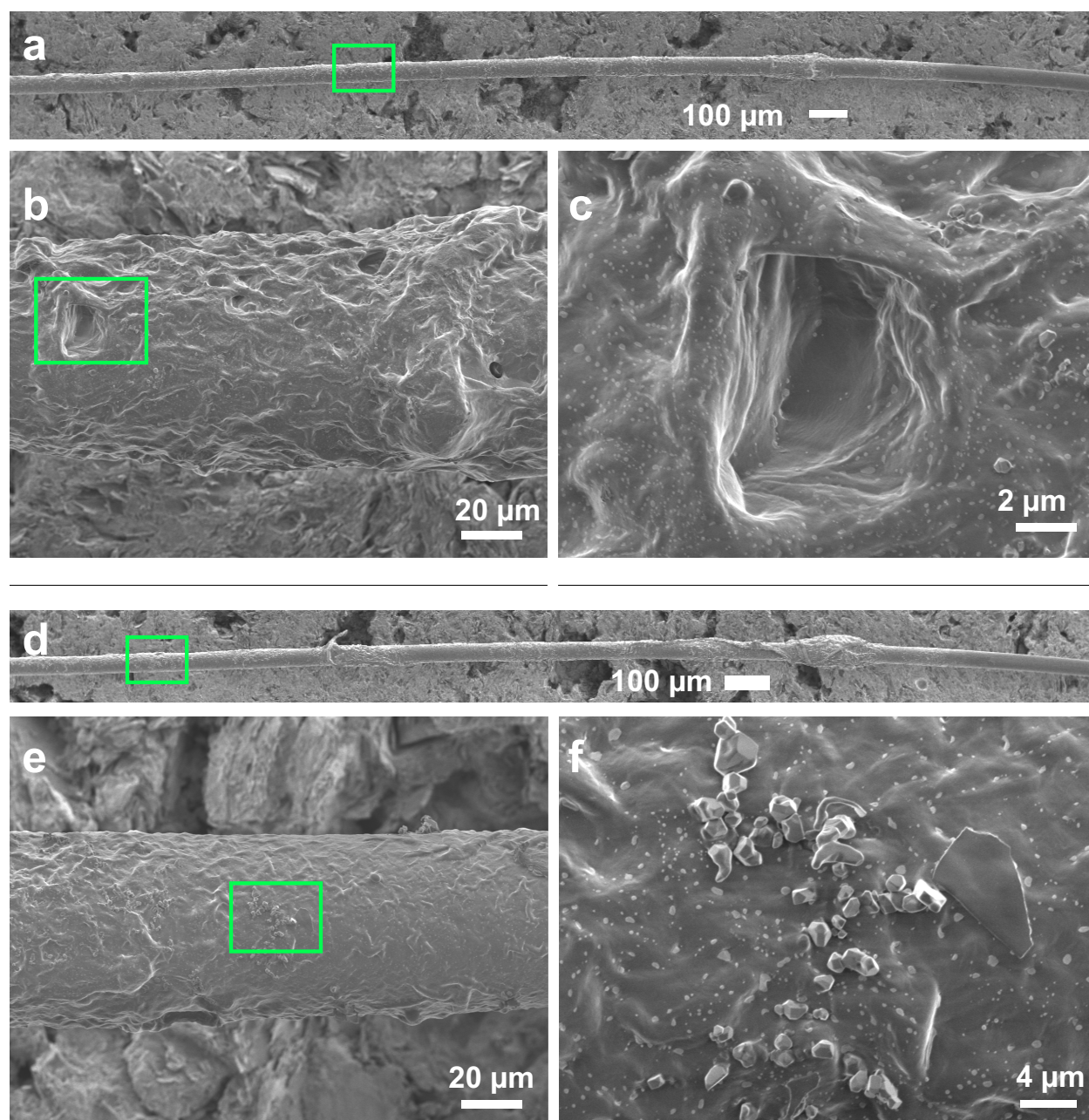
Figure S7. Additional SEM images of functionalized drug-loaded hydrogel microwires **Dex-Pt-Ir-PEG$_{3400}$** after immersion in PBS buffer.
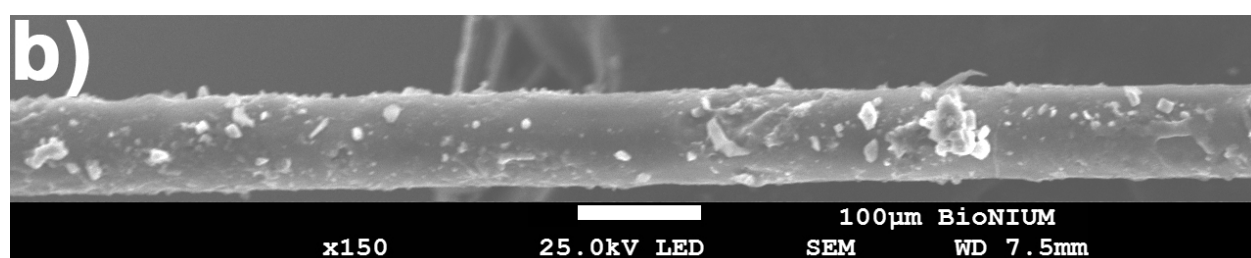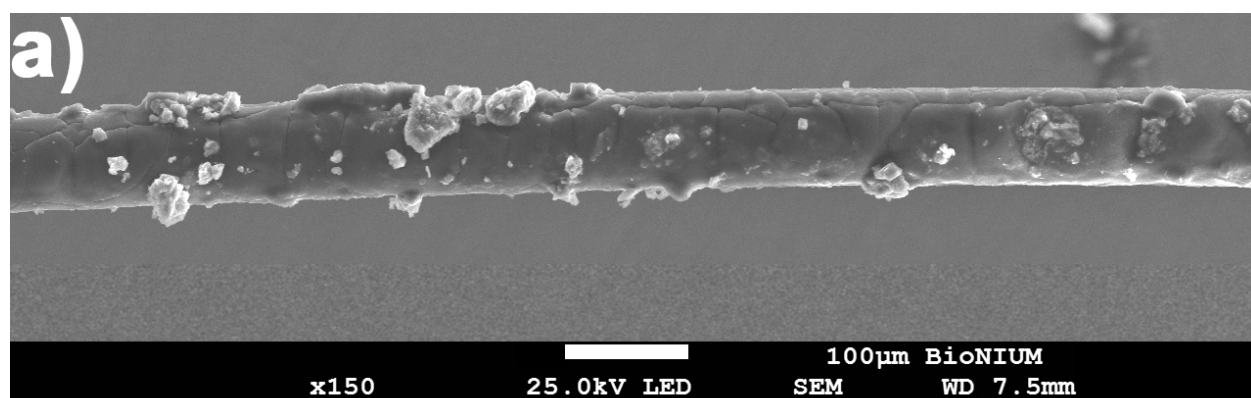
Figure S8. Additional SEM images of functionalized drug-loaded hydrogel microwires **Dex-Pt-Ir-PEG$_{550}$** fabricated with 50% w/w PEGDMA$_{3400}$, 8.9% w/w Dex, and EtOH/H$_2$O (3:1).

4. Additional Drug Release Profiles

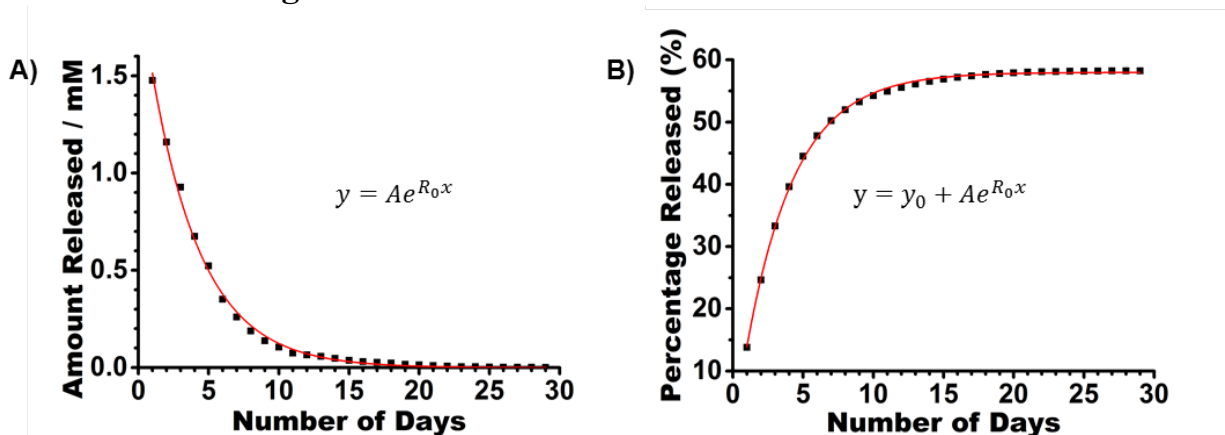A) $y = Ae^{R_0 x}$

B) $y = y_0 + Ae^{R_0 x}$

Figure S9. A) Dexamethasone release profile of **Dex1.1-PEG$_{3400}$** hydrogel. Data points were fitted exponentially, where $A = 2.00$ mM and $R_0 = -0.277$ d^{-1}. B) Percentage of the total amount of loaded drug released over time for the **Dex1.1-PEG$_{3400}$** hydrogel. Data points were fitted exponentially, where $y_0 = 58.0$, $A = -58.7$ and $R_0 = -0.287$ d^{-1}. Note: the hydrogel fabrication method and the drug release test method are the same as described in the main text except that this gel was air-dried instead of being dried under vacuum thoroughly.
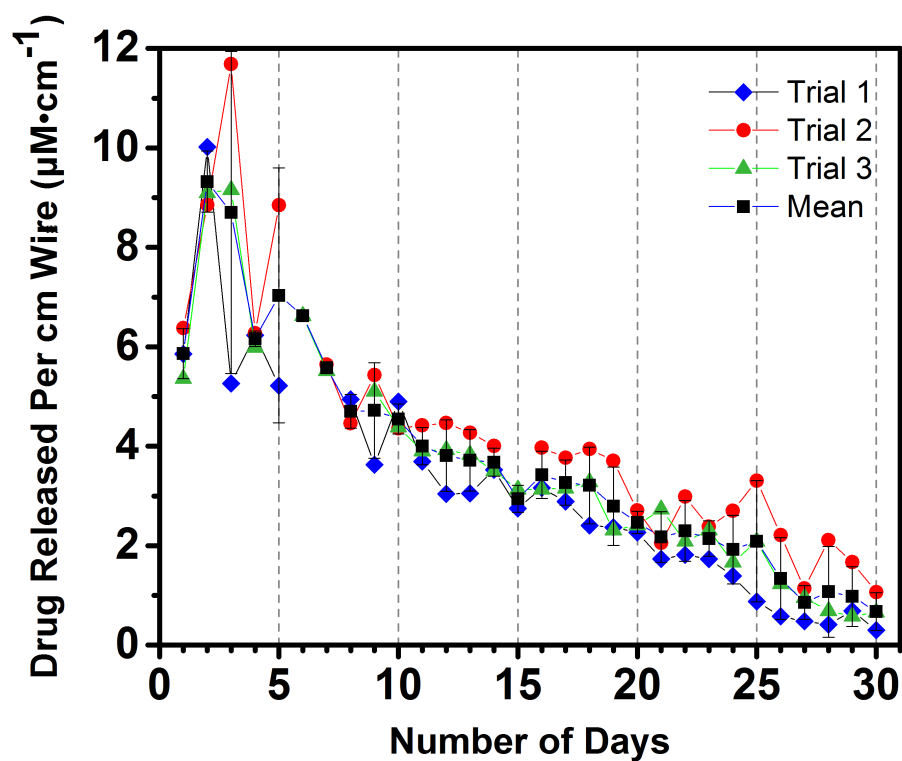
Figure S10. DEX release profile of Pt-Ir microwires coated with drug-loaded PEGDMA (MW ≈ 550) hydrogel, where the y-axis is the molarity of Dex released in the supernatant per centimeter of wire. All three trials were done in parallel, and the mean and standard deviation values were calculated and are presented here as well.

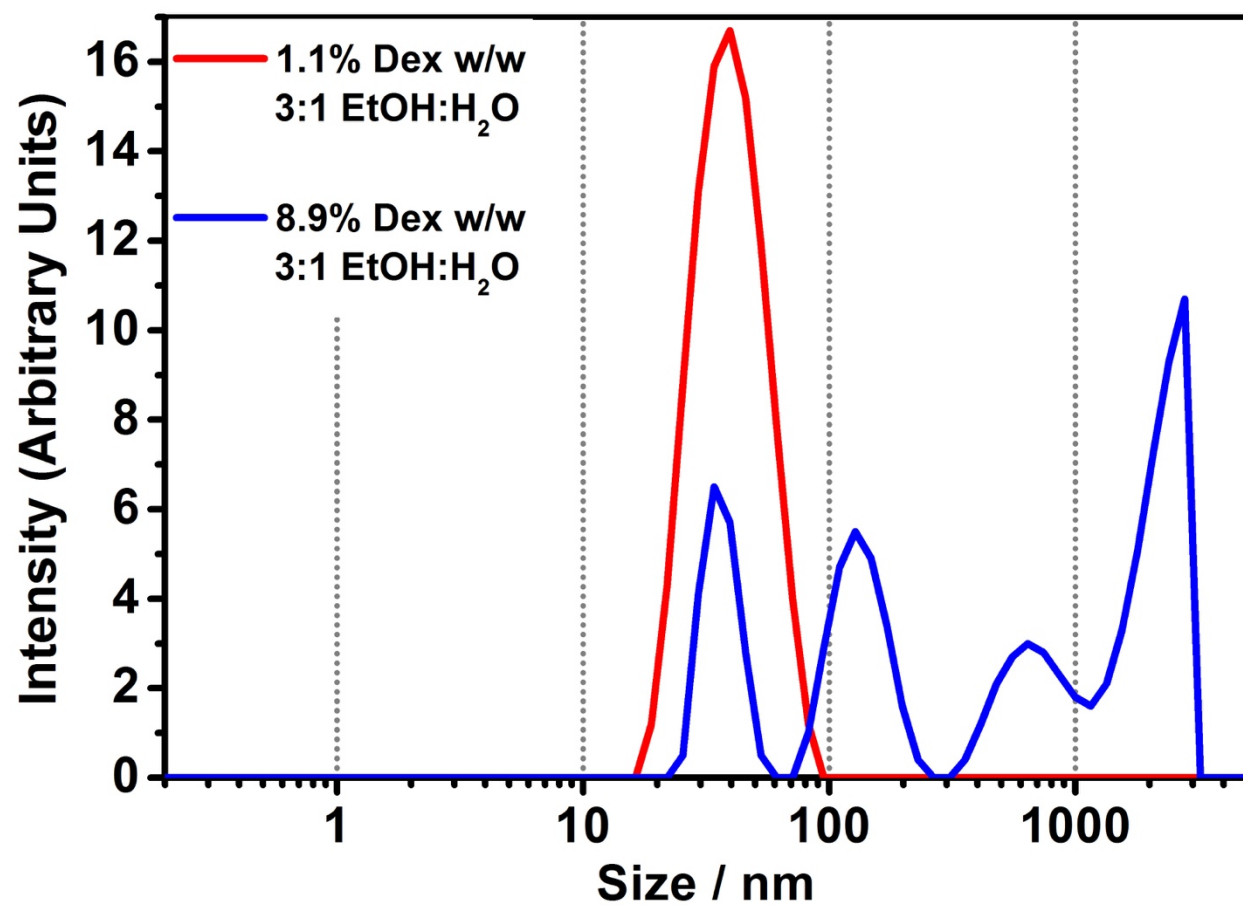**5. DLS profile of DEX aggregates.**

Figure S11. Average particle sizes of Dex aggregates as a function of Dex loading in 3:1 EtOH:H₂O recorded using dynamic light scattering experiments.

6. Movies Information

Movie S1. Optical microscopy recording of a functionalized drug-loaded hydrogel microwire fabricated with 50% w/w PEGDMA, 8.9% w/w Dex, and EtOH/PBS (3:1) being immersed in 1x PBS.

Movie S2. Optical microscopy recording of a functionalized drug-loaded hydrogel microwire fabricated with 50% w/w PEGDMA, 8.9% w/w Dex, and EtOH/H_2O (3:1) being immersed in 1x PBS.

7. References

1.   Bennett, C.; Samikkannu, M.; Mohammed, F.; Dietrich, W. D.; Rajguru, S. M.; Prasad, A., Blood brain barrier (BBB)-disruption in intracortical silicon microelectrode implants. *Biomaterials* **2018,** *164*, 1-10.

2.   Bennett, C.; Mohammed, F.; Alvarez-Ciara, A.; Nguyen, M. A.; Dietrich, W. D.; Rajguru, S. M.; Streit, W. J.; Prasad, A., Neuroinflammation, oxidative stress, and blood-brain barrier (BBB) disruption in acute Utah electrode array implants and the effect of deferoxamine as an iron chelator on acute foreign body response. *Biomaterials* **2019,** *188*, 144-159.

3.   Livak, K. J.; Schmittgen, T. D., Analysis of relative gene expression data using real-time quantitative PCR and the 2(T)(-Delta Delta C) method. *Methods* **2001,** *25* (4), 402-408.