

**Electronic Supplementary Material (ESI) for
Journal of Materials Chemistry B**

**Electrodeposited NaYF₄: Yb³⁺, Er³⁺ up-conversion films for flexible
neural device construction and near-infrared optogenetics**

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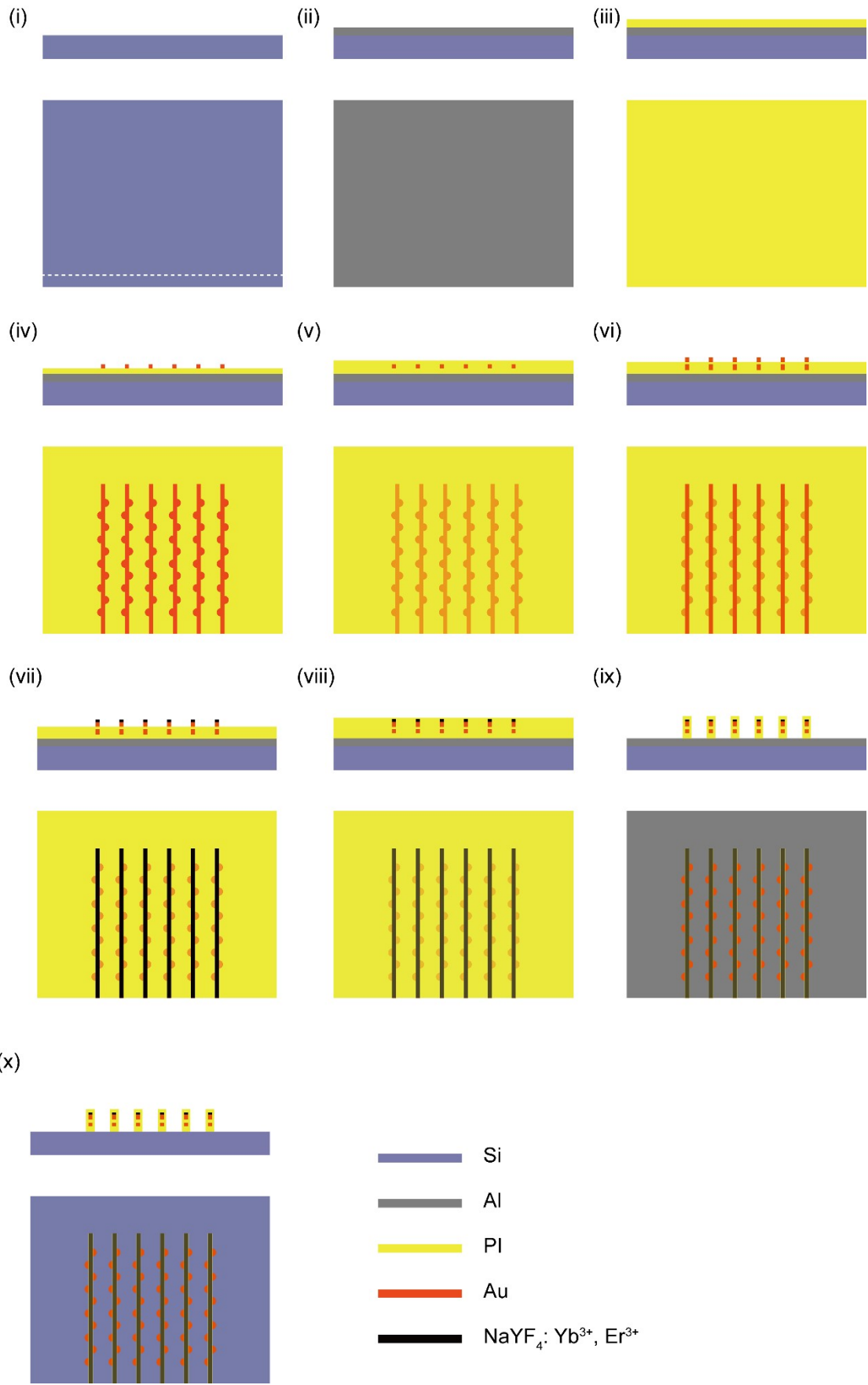


Figure S1. Schematics of flexible device fabrication process. (i) Silicon substrate. The side view corresponds to the position of the white dotted line. (ii) Deposition of aluminum sacrifice layer. (iii) Spin-coating of bottom PI layer. (iv) Deposition and patterning of gold layer for filament and microelectrodes. (v) Spin-coating of middle PI layer. (vi) Patterning and deposition of gold layer for electrodeposition of NaYF₄: Yb³⁺, Er³⁺ film. (vii) Electrodeposition of NaYF₄: Yb³⁺, Er³⁺ film. (viii) Spin-coating of top PI layer. (ix) RIE patterning of PI to form the flexible device and expose the recording sites. (x) Etching of aluminum to release the flexible device.

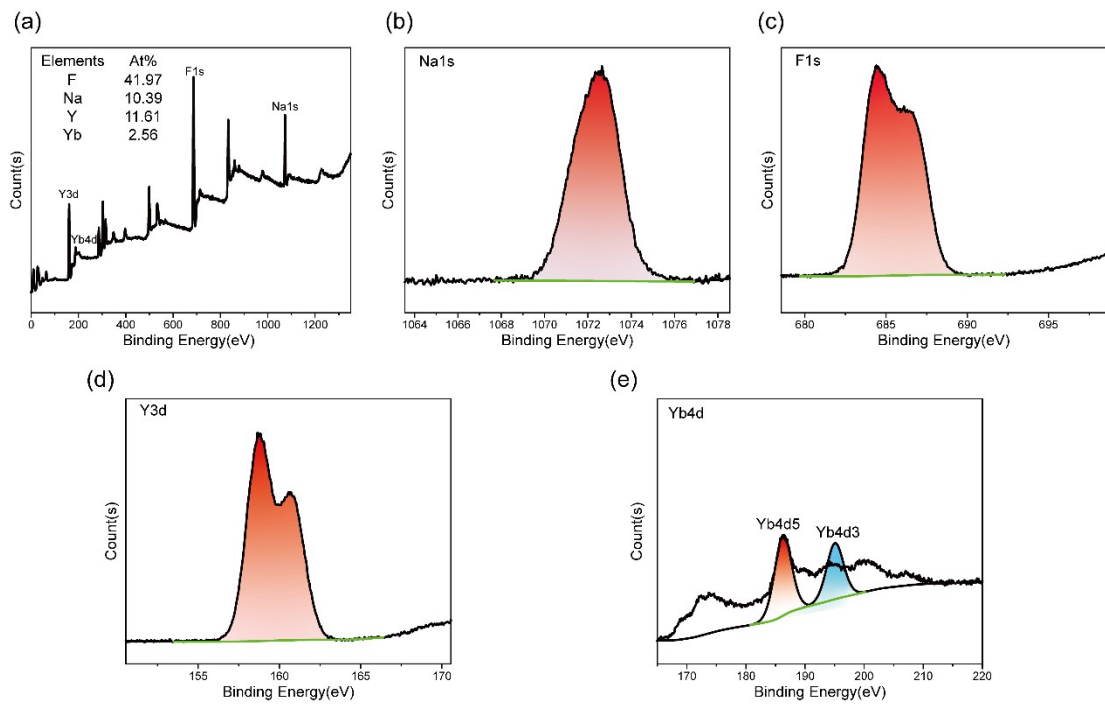


Figure S2. XPS spectrum of NaYF₄: Yb³⁺, Er³⁺ film. (a) XPS survey spectrum of NaYF₄: Yb³⁺, Er³⁺ film. (b) Local spectra for Na 1s analyses of NaYF₄: Yb³⁺, Er³⁺ film. (c) Local spectra for F 1s analyses of NaYF₄: Yb³⁺, Er³⁺ film. (d) Local spectra for Y 3d analyses of NaYF₄: Yb³⁺, Er³⁺ film. (e) Local spectra for Yb 4d analyses of NaYF₄: Yb³⁺, Er³⁺ film.

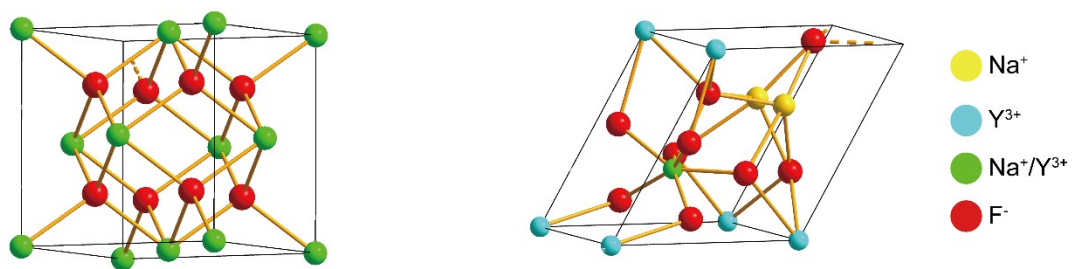


Figure S3. Schematic diagram of crystal structure of α -NaYF₄ (Left) and β -NaYF₄ (Right).

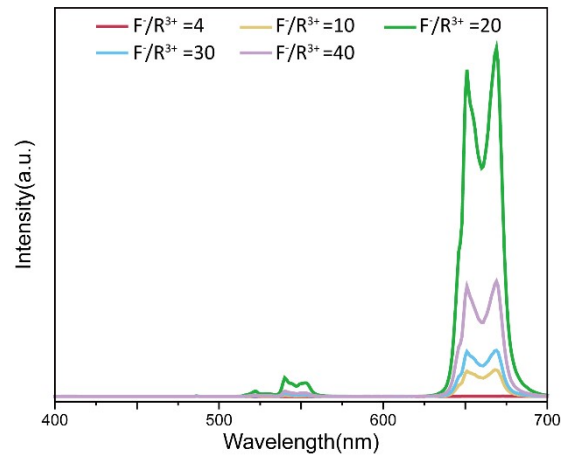


Figure S4. Fluorescence spectra in visible spectrum of UC films prepared at different F/R^{3+} ratios on the ITO substrate.

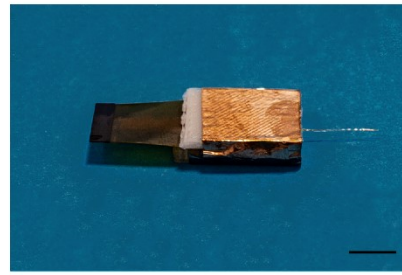
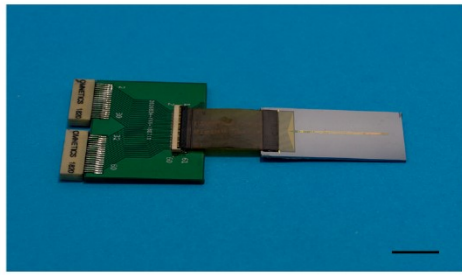


Figure S5. Photographs of a flip chip-bonded flexible neural device connected to a custom-designed PCB (Left, scale bar, 10 mm), and a self-assembled and packaged flexible neural device (Right, scale bar, 10 mm).

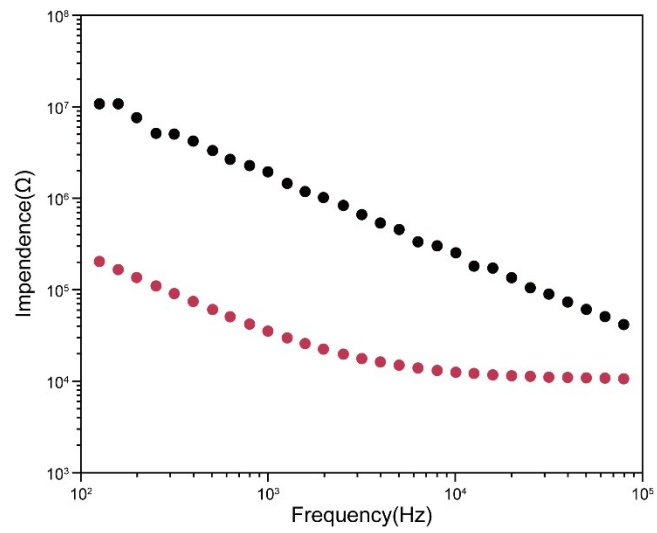


Figure S6. EIS of a recording site before (black) and after (red) nano-sized platinum electrodeposition.