CortiTrack: Decode Stress, Drive Care

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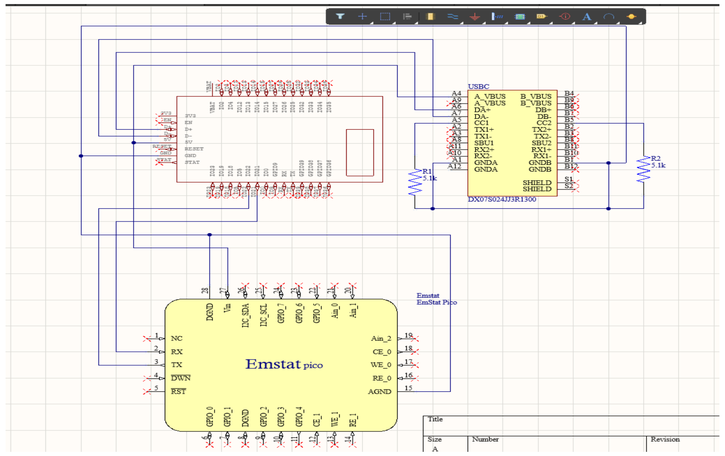
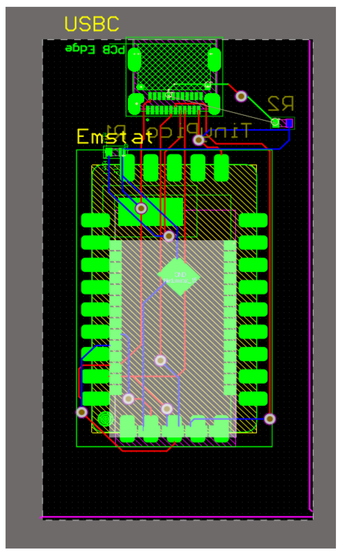
Introduction

Stress represents a significant health burden, costing US employers $300B annually, yet current methods for measuring cortisol—the body's primary stress hormone—rely on subjective reporting or infrequent lab tests providing only isolated snapshots. Despite cortisol's critical role as a biomarker for numerous chronic conditions, its complex molecular structure and sampling challenges have prevented real-time monitoring solutions. CortiTrack addresses this gap by developing the first continuous cortisol monitoring system, combining painless microneedle technology with advanced electrochemical sensing to transform invisible stress signals into actionable health intelligence.

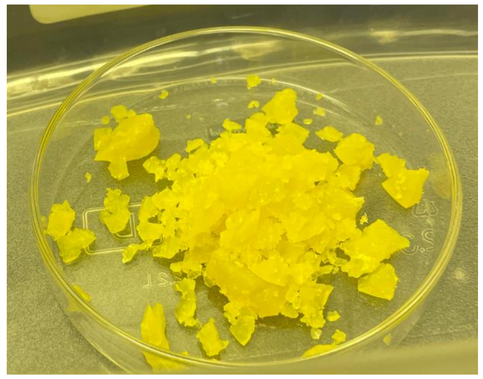
Electronic Schematics



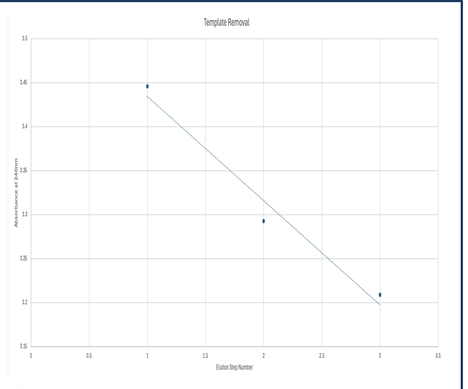


Using an Emstat Pico potentiostat we are able to apply square wave and cyclic voltammetry to measure cortisol using our E-MIP. The system includes a programmable tiny pico microcontroller and low-power Bluetooth transmission. This compact multi-layer PCB design is compatible with IOS and Android and is rechargeable via USB-C. Currently the dimensions of the PCB are 29mm x 45mm.

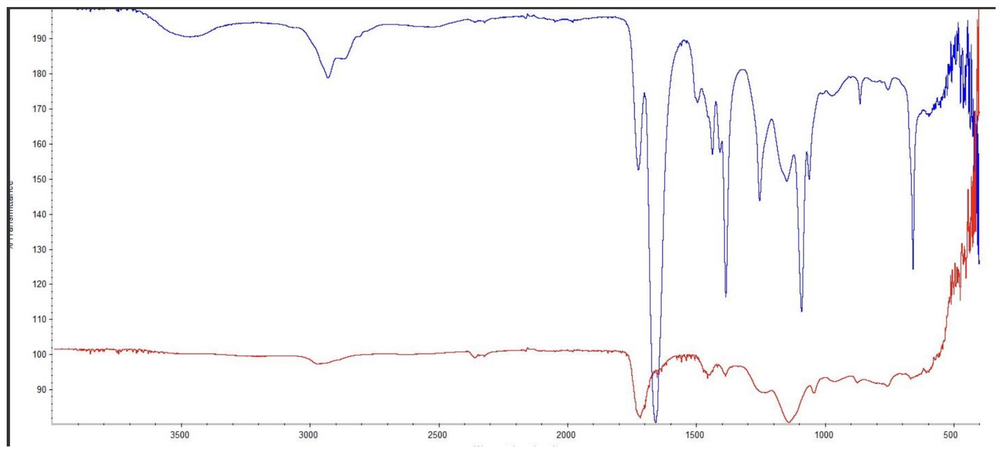
Electrochemical Sensor



Cross-linked ferrocene- based polymer.

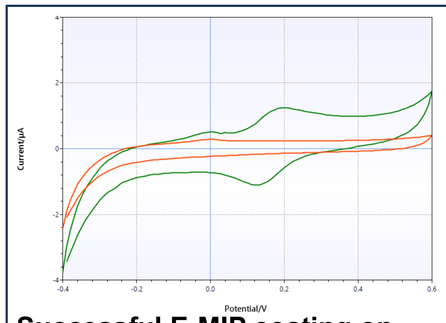


Decreasing absorbance at 240 nm indicating template removal.



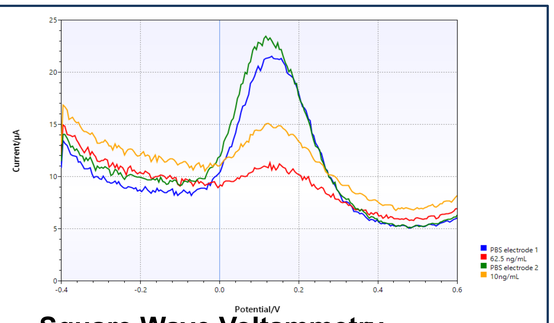
FTIR to characterize E-MIP formation and template removal.

Blue Line (pre-elution): Confirms polymer formation and presence of cortisol. **Red Line (post-elution):** Missing peak in hydrogen bonding region indicates successful removal of cortisol template.



Successful E-MIP coating on electrode.

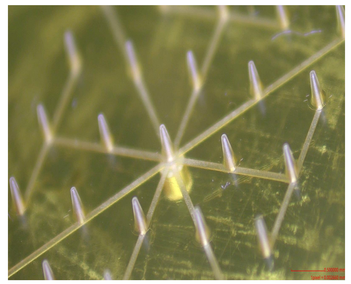
Green Curve (E-MIP modified SPE) shows ferrocene redox peaks when CV is applied **Orange curve (unmodified SPE):** Shows no electrochemical activity



Square Wave Voltammetry.

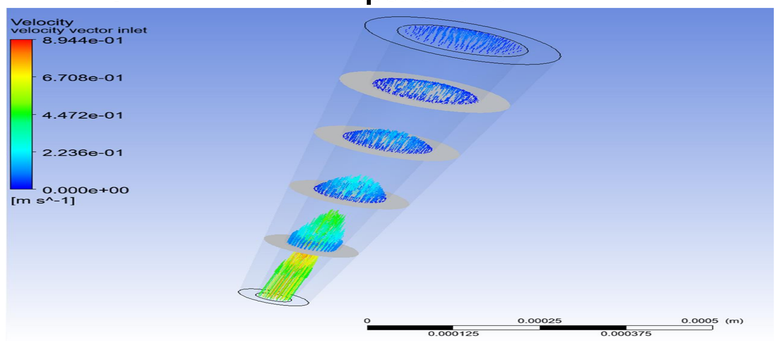
As concentration of cortisol increases, signal is suppressed.

Microneedle Array Testing



Microneedles 3D printed using biocompatible resin.

Testing mechanical strength and depth of skin penetration.



Flow testing results – velocity vector for 3D model.

Using Ansys Fluent to simulate fluid uptake functionality. Flow rate: 0.0023mL/s per needle.

Overall Device Schematics