# Electrically-Fueled Active Materials

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## Dissipative Self-Assembly

Fuel-driven self-assembly is ubiquitous in natural systems, leading to complex phenomena including cell motility, cell division, camouflage, and self-healing. Creating synthetic equivalents of these biological assemblies is challenging but offers the reward of active, dynamic materials.

## Electrically-Fueled Assembly

Current synthetic dissipative self-assembly systems are fueled either by chemicals or light. Here, the UCI MRSEC team have developed the *first* electrically-fueled dissipative system that offers rapid kinetics, directionality, and unprecedented spatiotemporal control, closely mimicking systems found in nature. The electrochemically-fueled active, dynamic, and directional assembly is shown in Figure 1. Excitingly, the system demonstrates an unprecedented level of spatiotemporal control of self-assembly (Figure 2).

The team is now working on expanding this chemistry to a completely waste-free dissipative system. The transient behavior of dissipative self-assembly using dual electrocatalysts without generating any waste has been preliminarily demonstrated (Figure 3).

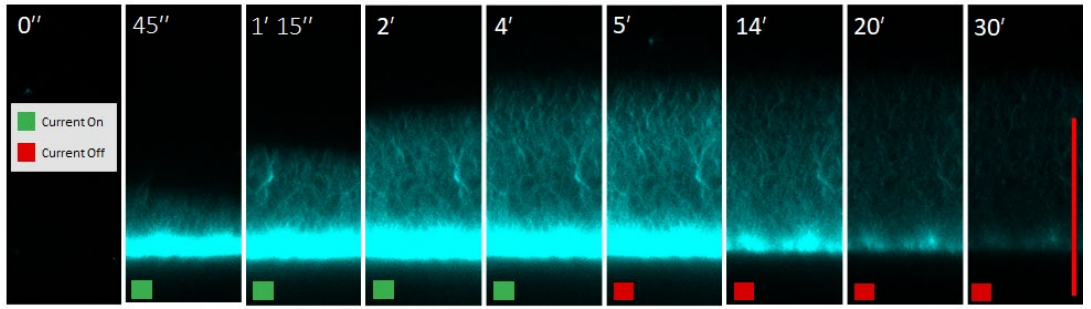


**Figure 1.** Fluorescence snapshots showing directional fiber growth when current was applied (green square), and dissolution when current was turned off (red square), scale bar = 50 μm.

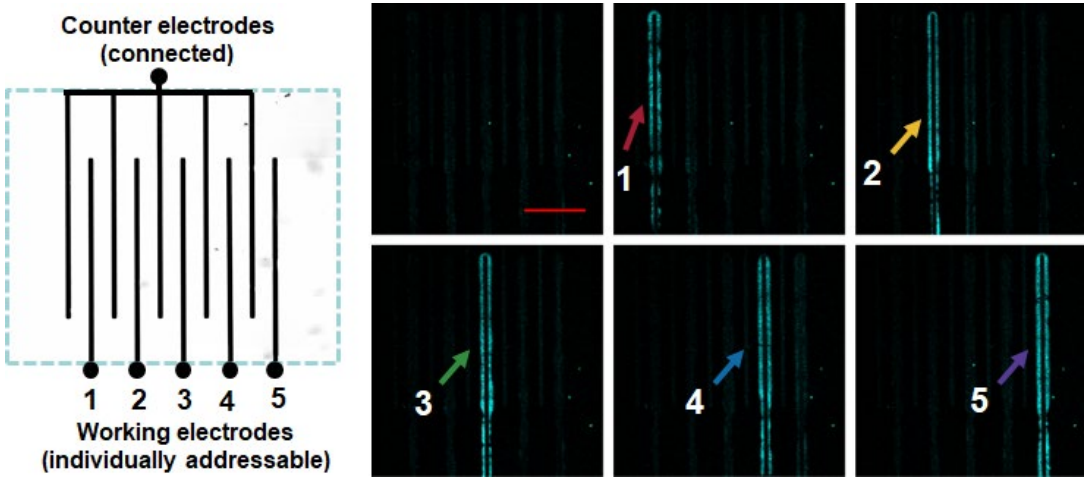


**Figure 2.** Controlled growth and disassembly at individually addressable electrodes demonstrating unprecedented spatiotemporal control over dissipative self-assembly.

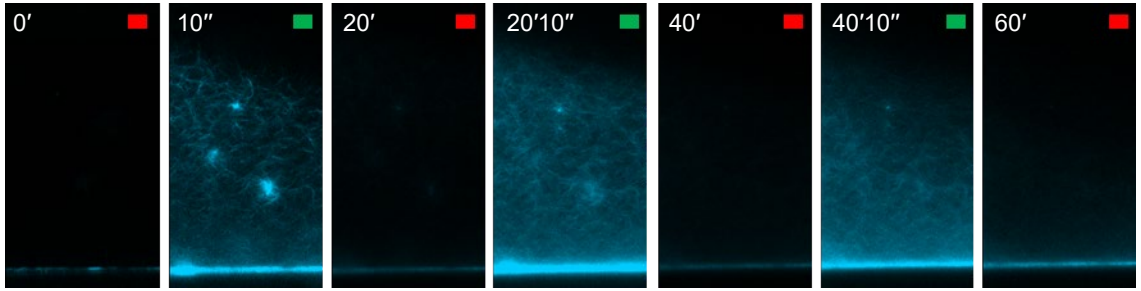


**Figure 3.** Fluorescence snapshots showing fiber growth under voltage (green square) and dissolution when voltage is turned off (red square), scale bar = 100 μm.

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