Cooling-Triggered Self-Destructing Electronics

VANDERBILT UNIVERSITY
CTTC Center for Technology Transfer & Commercialization

Technology Description

Vanderbilt University researchers have developed self-destructing electrical conductors that dissolve and vanish below a certain critical temperature, which is achieved either by actively cooling the circuit or by removing a heat source.

Addressed Need

What happens to electronics that have outlived their usefulness? Removing a circuit from its environment can be difficult, expensive, and dangerous. Simply leaving it in place adds to the growing problem of e-waste and can be a security risk for sensitive information. Transient electronics solve this problem by disappearing harmlessly after a certain time or in response to a specific stimulus. For the present technology, that stimulus is active cooling of the circuit or the removal of a heat source. Thus, the circuit can be triggered to self-destruct and/or configured to dissolve from neglect.

Potential Applications

- **Medical implants** that dissolve upon targeted external cooling or death, eliminating the need to surgically remove the device
- **Secure self-destructing electronics** that keep sensitive information or advanced technology from falling into the wrong hands
- **Zero-waste environmental sensors** that disappear instead of needing to be manually recovered
- **Reconfigurable electronic systems** that can change function by eliminating elements of the circuitry
- **Consumer electronics** that disappear at the end of their lifetime, reducing or eliminating e-waste

Unique Features

- Circuit dissolves **below** critical temperature
- Stable operation above critical temperature
- Circuit dissolves faster than other transient electronics
- Higher performance and efficiency than traditional transient electronics

Technology Development Status

Researchers have successfully developed prototypes of the conductors and are working to further improve the circuit stability when kept above the critical temperature.

Intellectual Property Status & Publications

US patent application 2018/0174976

"Composites Formed from Thermoresponsive Polymers..."*ACS Appl. Mat. & Int., 2017, 21991-97.*

"Thermoresponsive Transient Radio Frequency Antennas", Adv. Mat. Tech., 2019, 1900528.

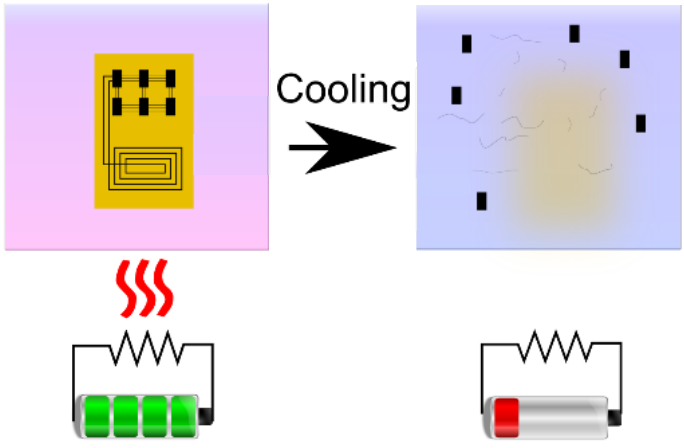

Figure 1: When the circuit is in a solution above the critical temperature (left), the circuit is intact and functional. When the circuit is cooled to below the critical temperature (right), it dissolves and disappears.

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