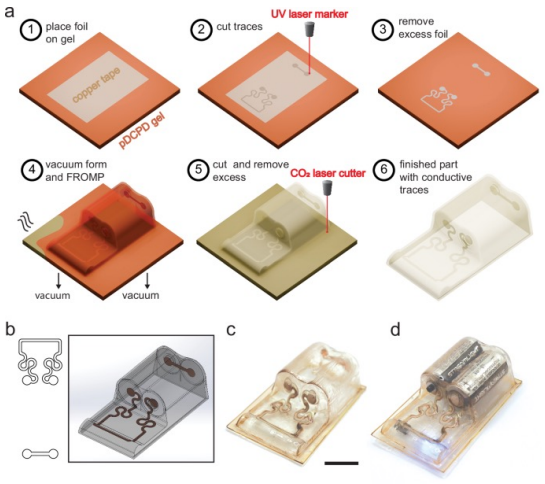
# Structural Electronics using Autocatalytic Thermosets

## Scientific Achievement

This work enables 3D device fabrication using an In-Mold Electronics (IME) approach and integration into a wider range of durable products, extreme environments, and complex architectures.




a) Process for creating structural electronics from thermosets.
b) Trace, mold, and placement design for a power module.
c) Photo of the module with copper traces. Scale bar is 20 mm.
d) Functional LED circuit operated by a switch.

## Significance and Impact

Vacuum forming is a ubiquitous manufacturing process requiring meltable thermoplastics, which are not compatible with extreme environments. An energy-efficient vacuum-forming approach for thermoset materials was enabled by moldable gels that lock into shape through autocatalytic curing.

## Research Details

- Dicyclopentadiene (DCPD) is prepared into a gel that is vacuum formed into 3D structures and subsequently cured by localized heating propagated throughout the part via frontal ring-opening metathesis polymerization (FROMP).
- Electronic traces patterned onto gel surfaces conform into 3D shapes to generate rugged, thermoset-based structural electronics.

Work was performed, in part, at the Center for Integrated Nanotechnologies.

Fowler, H. E.; Taylor, M. S.; Nguyen, C. P.; Boese, D. A.; Baca, E.; Greenlee, A. J.; Kaufman, G. E.; Gallegos, M. A.; Huntley, E. F.; Appelhans, L. N.; Kaehr, B.; Leguizamon, S. C. Frontal Polymerization of Thermosets to Enable Vacuum-Formed Structural Electronics. *Nature Communications* **2025**, *16* (1).