



MAKING THERMOSET COMPOSITE RECYCLING AN INDUSTRIAL REALITY

NextSet Materials

a Cyclotron Road Company

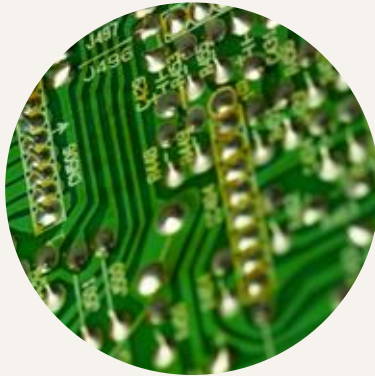
Recovering carbon fiber and valuable metals from traditional industrial and electronic composites for the first time.

Yasmeen AlFaraj, PhD, Founder & CEO

ABLC Next 2026 · San Francisco · nextset.net

THE CHALLENGE

Plastics are remarkable materials, with tunable properties across a range of essential industries.



Electronics



Aerospace



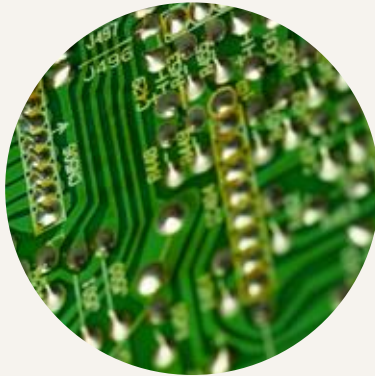
Automotive



Structural Materials

THE CHALLENGE

Thermoset plastics cannot be melted, dissolved, or remoulded: locking-in valuable materials.



Electronics



Aerospace



Automotive



Structural Materials



Precious metals



Carbon Fiber

THE PROBLEM

Thermosets lock-up billions in reinforcing materials, worth far more than the plastics themselves.

SCALE OF THE PROBLEM

20%

of all plastics manufactured are thermosets

65M t

landfilled every year

VALUE LOST · E-WASTE

\$91B

in metals lost to landfilled e-waste in 2022

40–800x

richer in gold than U.S. ore, per tonne

VALUE LOST · COMPOSITES

>4x

the price of carbon fiber vs. the resin it's locked in

~1.5x

more fiber than resin by volume in CFRP

WHY THERMOSETS

What makes thermosets irreplaceable



RIM amenable

Fast reaction injection
molding of large, complex
parts



AM amenable

High-fidelity 3D printing
(photo-ROMP, FROMP)



Tough

Impact resistant — takes a hit
and keeps working



Incredibly lightweight

Exceptional strength-to-
weight



High mechanical strength

> 1 GPa



Stable under load

Dimensional stability when
load bearing > 150 °C



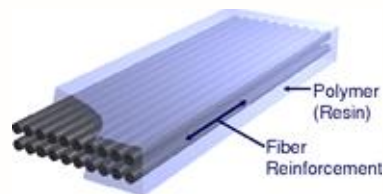
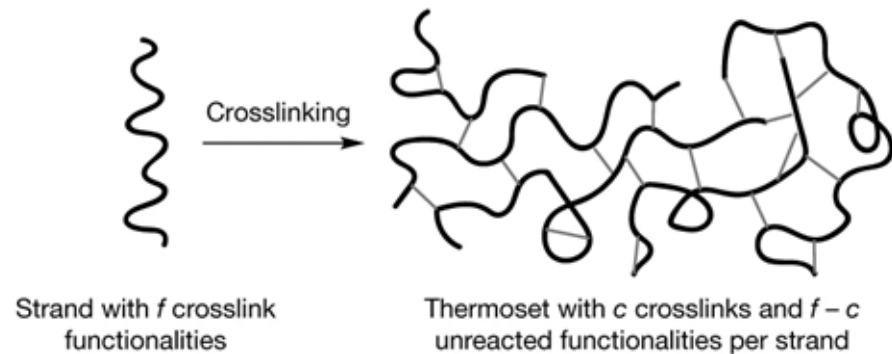
Existing equipment

Compatible with today's
manufacturing
instrumentation

→ Desirable for the
most challenging
application spaces and
conditions

THE CHEMISTRY

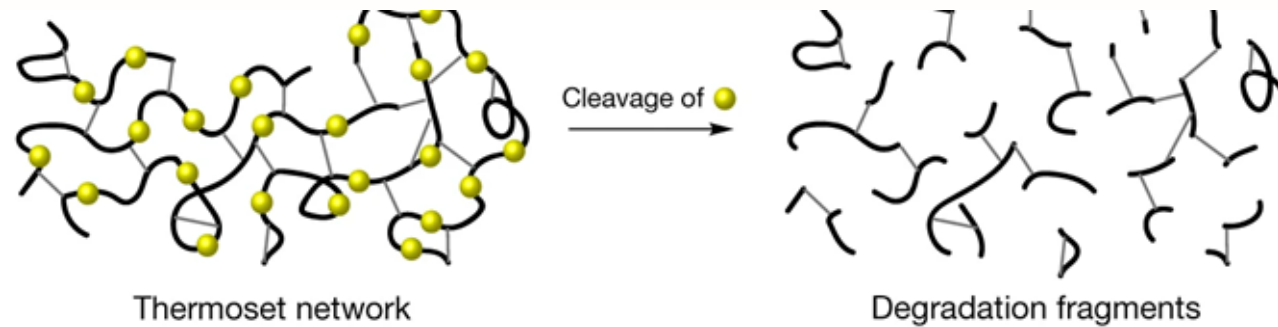
Inert crosslinking in thermosets is compatible with harsh conditions, but incompatible with reprocessing!



- 1 Linear chains: thermoplastics**
Held together by weak interactions. Heat or solvent lets chains slide apart: they melt, dissolve, remold.
- 2 Crosslinked network: thermosets**
Irreversible bonding in thermosets means instead of melting, they harden and char when heated, and are not recyclable.
- 3 In a composite**
The thermoset matrix coats and binds the fiber and metals, locking in these reinforcing materials as you cannot separate the resin.

HOW IT WORKS

NextSet's approach: triggerable cleavable additives



Shieh, P., et al. *Nature* 583, 542–547 (2020)

1

Integrate

Added during standard thermoset manufacturing at low loadings (~5-12 wt%).

2

Perform

Full thermoset properties retained: high-T performance, dimensional stability, processability.

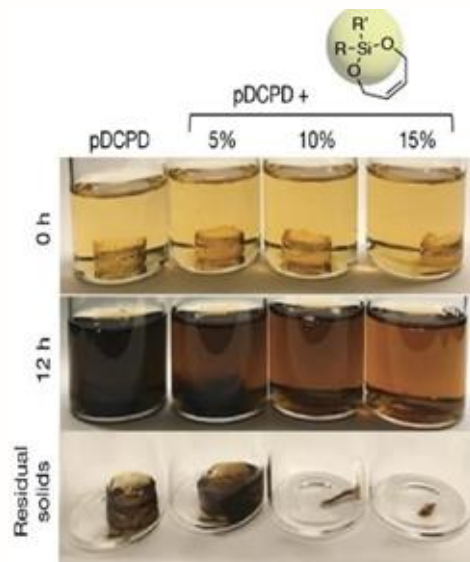
3

Deconstruct

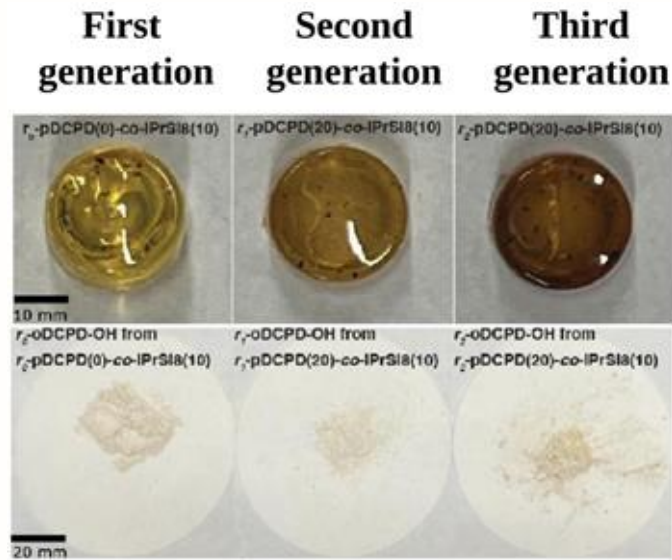
At end of life, a mild chemical trigger cleaves the additive bonds and releases the trapped materials.

WHAT WE'VE ACHIEVED · RECYCLING

Selective deconstruction followed by recycling, showcased multi-generational recycling.



Deconstruction vs. additive loading



Thermosets (top) and the fragments they return to (bottom)

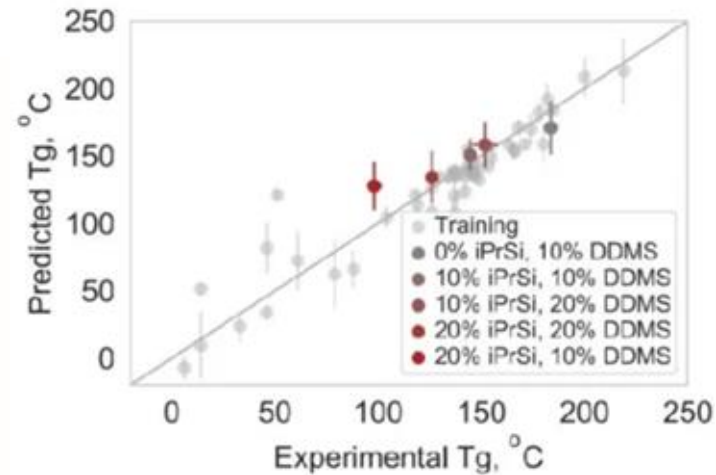
3x

generations of
deconstructable, recyclable
pDCPD

No chemical post-processing
required for reintegration.

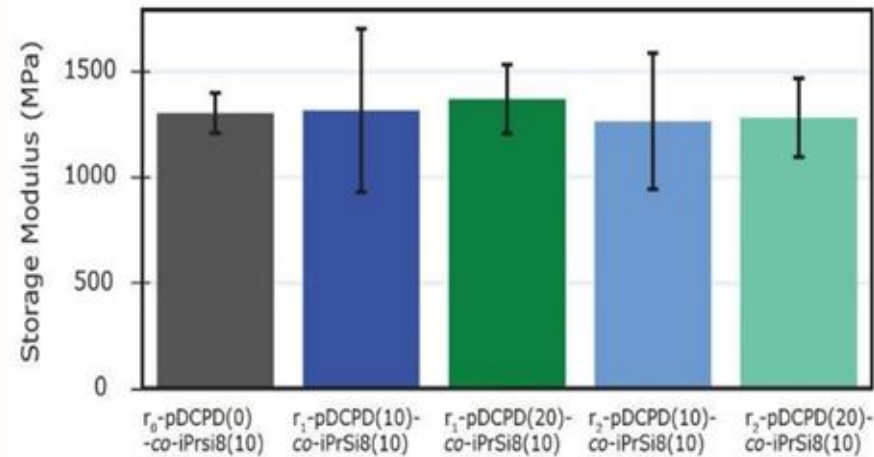
Predictable materials properties hold

T_g approaching virgin materials



DMA tan δ , predictable and experimentally validated in deconstructable networks

Storage modulus (MPa), first → third generation



r_0 = virgin · r_1 = once recycled · r_2 = twice recycled

~1.3 GPa

storage modulus, held across generations

~160 °C

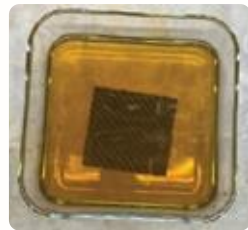
tan δ peak (T_g) achievable while maintaining deconstructability

WHAT WE'VE ACHIEVED · RECOVERY

Recovery of woven carbon fiber and valuable reinforcing materials from industrial-standard laminates



mild cleaving agent



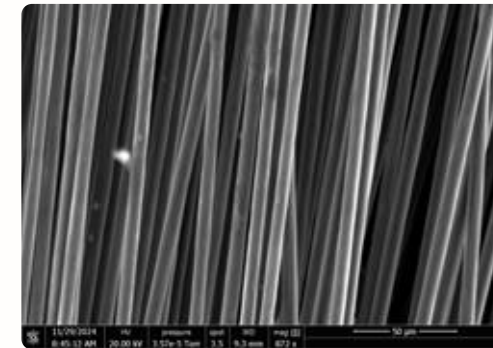
Then recover, wash
and dry the fiber ↓



Every woven layer is recovered as a separable layer of continuous fabric, instead of the industry standard of chopped fiber. The same release mechanism is being tailored to metal-bearing electronics laminates.

100%

fiber recovery of woven carbon fiber



Pristine recovered woven CF by SEM

Recycled resin prints at high fidelity



Energy-efficient FROMP-initiated direct-ink-write



Deconstructable

Deconstructable, recycled

Photo-initiated 3D printing (photo-ROMP)

Two print routes, recycled content, no loss of fidelity.

WHERE WE STAND

Full thermoset performance, plus recoverability

REQUIREMENT	Thermosets	Thermoplastics	Dynamic	NextSet
High-temp performance	✓	—	✓	✓
Dimensional stability · under load	✓	—	—	✓
Established feedstocks	✓	✓	—	✓
Manufacturability (RIM, AM)	✓	✓	—	✓
Recyclable	—	✓	✓	✓
Fiber separable from composite	—	✓	✓	✓

RECOGNITION

As featured on



Forbes 30 Under 30, 2026

Manufacturing & Industry



Composites Weekly

Featured in the composites trade press



Interesting Engineering

Featured

Supported by



Cyclotron Road

Fellow · Lawrence Berkeley National Lab,
DOE-backed



Activate, Berkeley

Activate Fellow, cohort 2025.



Based on MIT PhD research

MIT spin-out, built on Ph.D. Chemistry
work

MARKETS

Structural and electronic materials.

BEACHHEAD

Motorsport



200–250 kg CFRP per F1 car; **8–18 t** grid-wide scrap a year.

Fast iteration, available budget, low certification burden.

EXPAND

Auto, aero & sporting



\$38B automotive composites market.

Same resin chemistries and processes; cycling, skiing and racquets add volume.

LONG PLAY

Electronics



\$80B PCB market; **\$12B** high-performance PCB core.

PCB substrates and power-electronics encapsulants, where metal recovery creates clear ROI.

MINIMAL CAPEX, HIGH ROI

What this unlocks for manufacturers



Shorter lead times

Decision-makers told us a 10–20% lead-time cut justifies materials overhaul.



Lower material costs

Carbon fiber costs $>4\times$ the resin; e-waste is 40–800 $\times$ richer in gold than ore. Recover instead of re-buy.



Manufacturability

Compatible with RIM, 3D-printing and existing prepreg lines.



Resilient supply chains

Local recovery cuts exposure to raw-material price hikes and supply-chain insecurity, while relying on established industrial thermosets.



Drop-in compatible, unlocking a secondary revenue (and sourcing) stream.

NextSet Materials

Making thermoset recycling an industrial reality.

Let's connect, especially if you work in:

Electronics packaging

PCB substrates, encapsulants, power-electronics modules: materials testing and recovery pilots

Structural thermoset composite recycling

CFRP scrap, prepreg, motorsport and sporting composites

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