

Sustainable Polyurethane-Al Composite Recycling via Catalyzed Polymer Extrusion

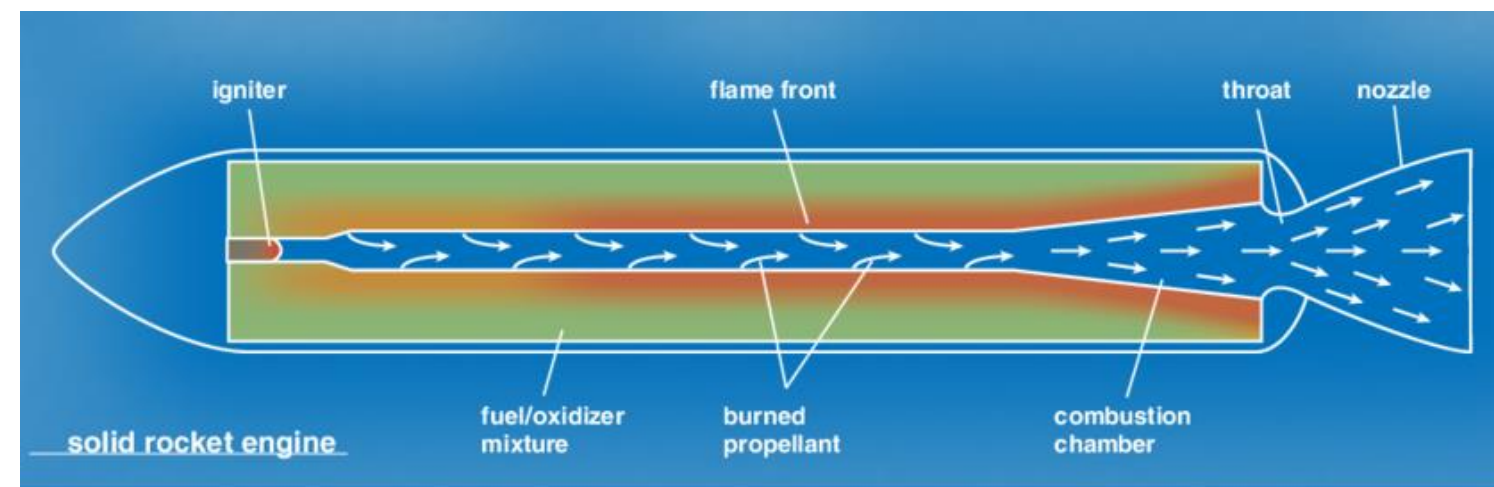
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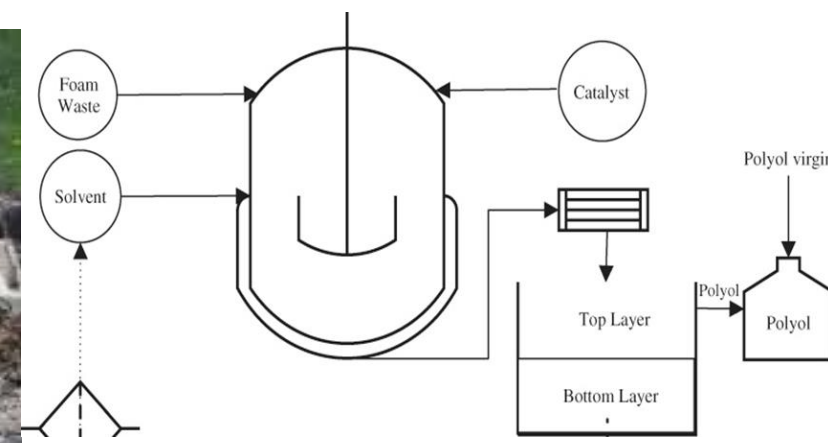
School of Engineering for Matter, Transport and Energy (SEMTE)

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Introduction of PU Composites and Market Need

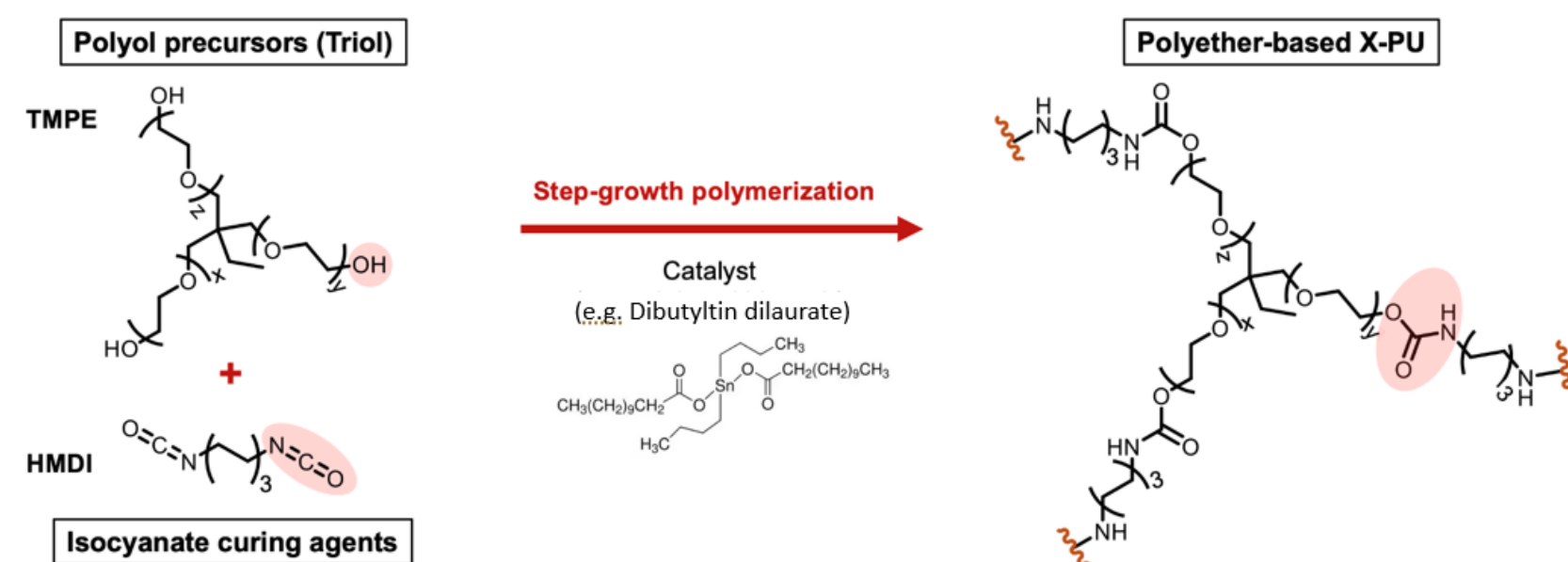


The United States has large stockpiles of solid rocket motors (SRMs), composed of inorganic-polyurethane composites. Need for a sustainable disposal strategy.



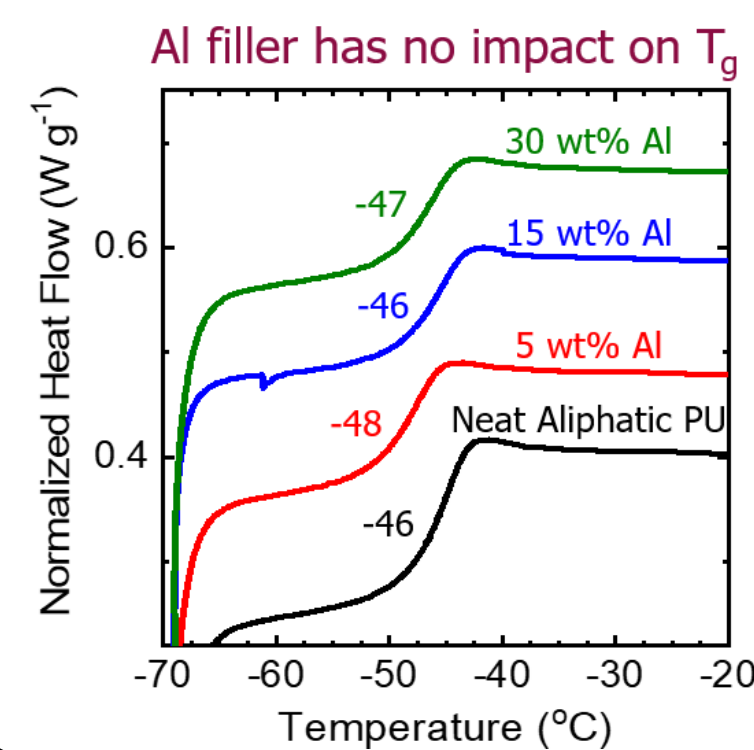
Burning, solvolysis, and landfilling are poor solutions for a disposal strategy.

Synthesis and Characterization of model X-PU/Al Composites

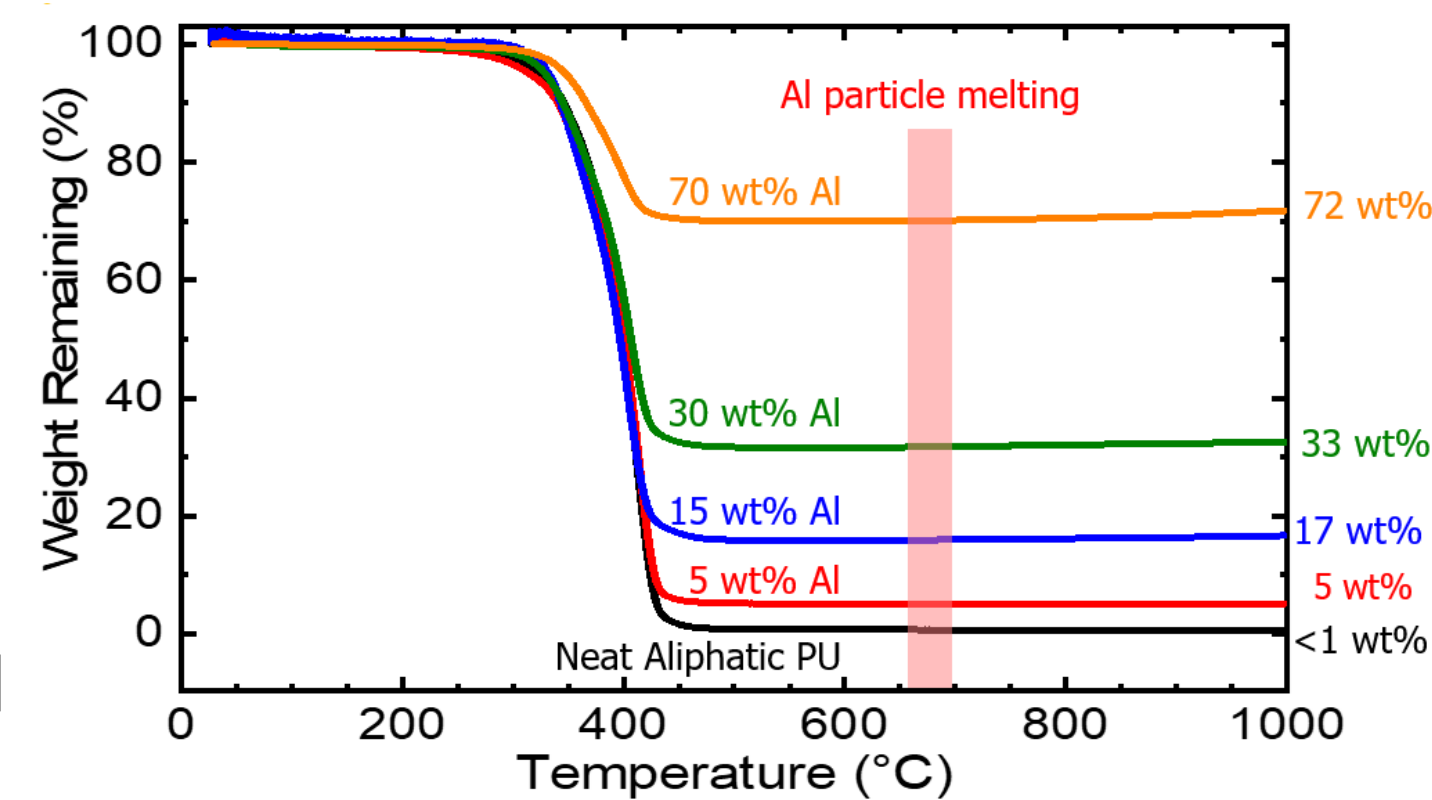


Ground Al/X-PU composite serves as the model SRM.

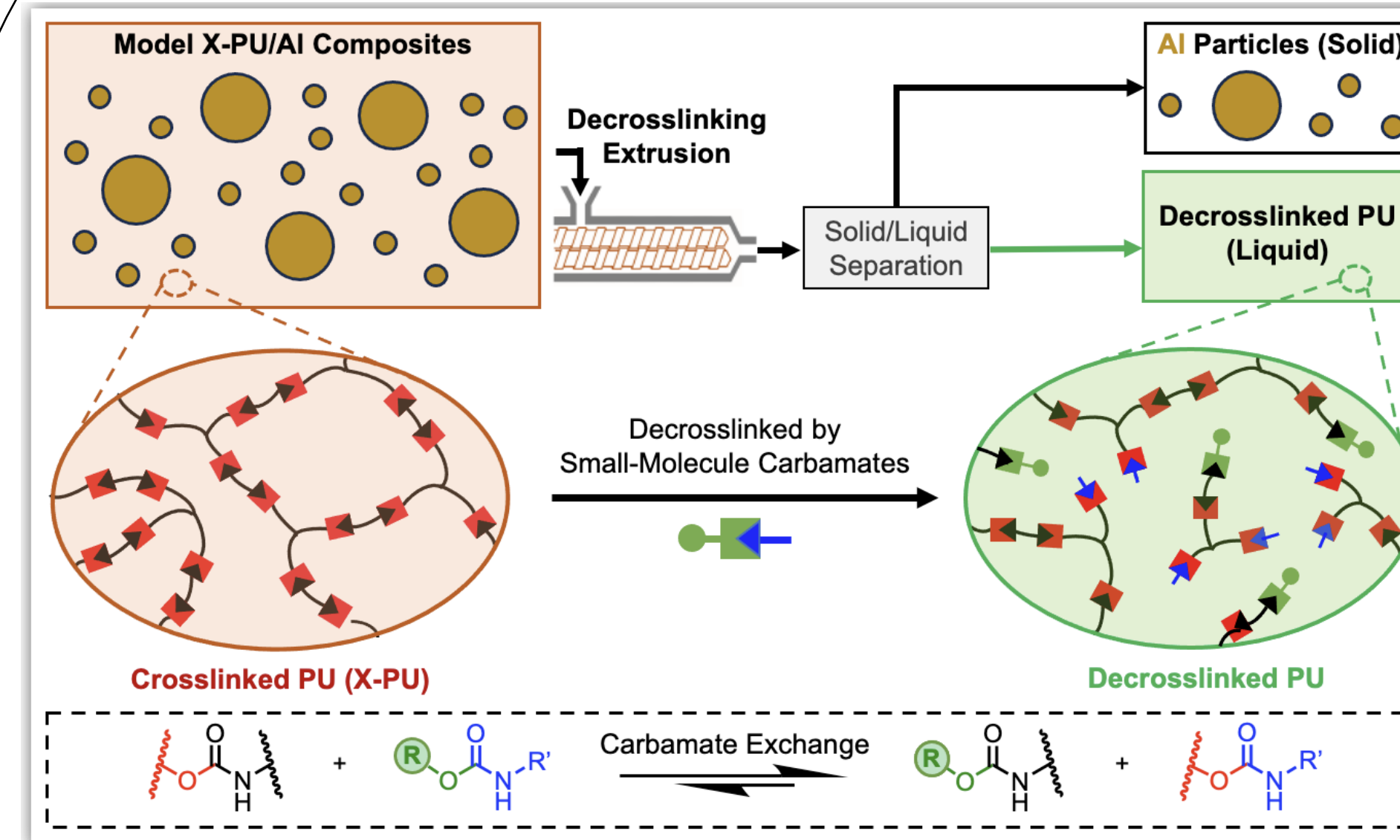
Performing step-growth polymerization reaction between polyol and aliphatic isocyanate combined with Al particles.



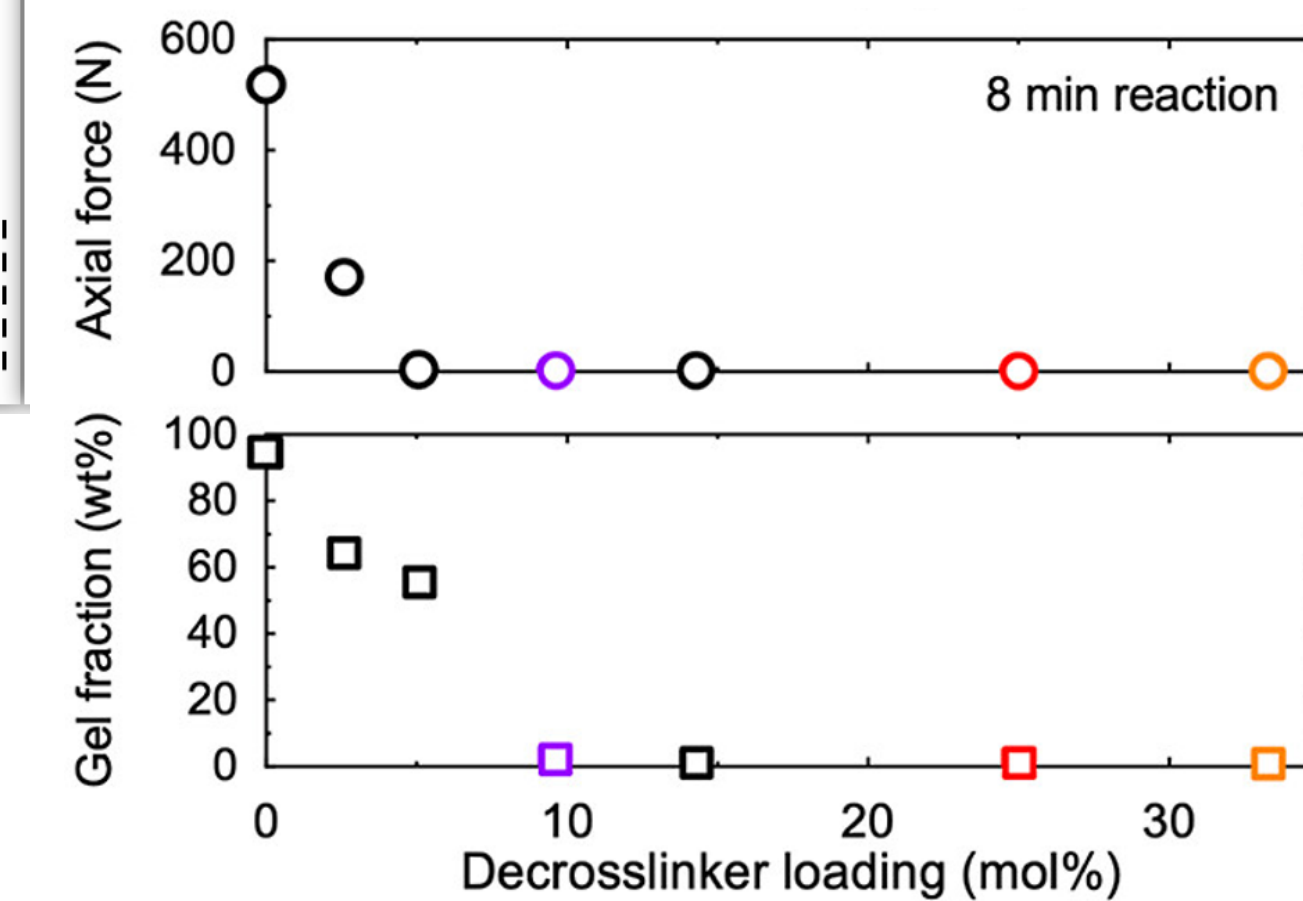
DSC and TGA results show polymer binder material properties are unaffected by Al loading.



Decrosslinking Via Reactive Extrusion



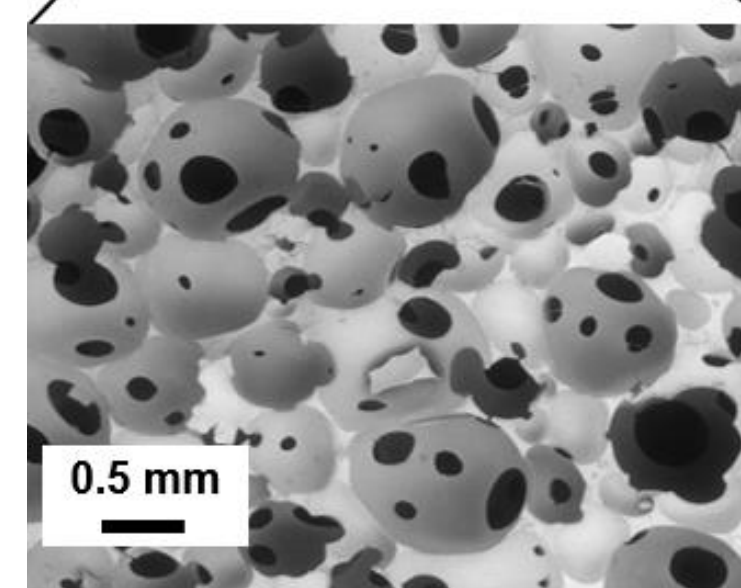
Reactive extrusion of PU composite allows for rapid, low energy, and solvent-free separation of inorganic composite materials from polymer (i.e. PU) binder. Decrosslinked PU monomers and inorganic particles may then be disposed of or upcycled.



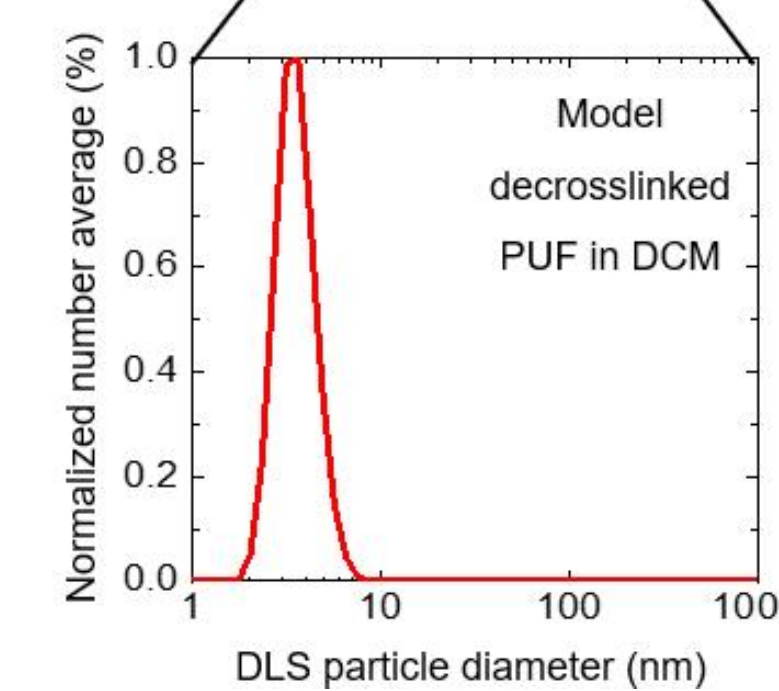
Model crosslinked PUF



SEM



Decrosslinked PUF in solvent



Decrosslinked Al-PU composite in acetone



Neat Al particles in acetone