# Advancing biological & man-made systems for societal & environmental challenges

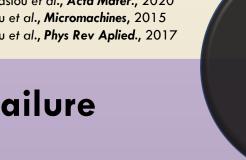
#### New multiscale testing methods

- Optics + mechanics
- Automated testing
- Data-driven experiments

Liu, Athanasiou et al., PNAS, 2021 Liu, Athanasiou et al., Acta Mater., 2020 Athanasiou et al., Micromachines, 2015 Athanasiou et al., Phys Rev Aplied., 2017

## New deformation/failure mechanisms

- Crack deflection criteria
- Environmentally-assisted degradation
- Chemo-mechanical failure



Athanasiou et al., *JMPS*,2022 Nazir, Athanasiou et al., *JNCS*, 2022

#### Materials & manufacturing

- Composites
- Biomaterials
- Multiscale 3D printing
- Laser manufacturing

The Daedalus Lab



Athanasiou et al., Carbon., 2021

Stathatou, Athanasiou et al., Nat Com Earth & Env., 2022

Athanasiou et al., Matter, 2020
Athanasiou et al., Cell Rep Phy Science
Stathatou, Athanasiou et al., US Patent Pending

#### **Applications**

- Solid-state batteries
- **Bioremediation**
- Green aviation
- Sustainale space exploration

### Selected media coverage of Pl's work

**Forbes** 

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#### Beer Byproduct Can Filter Lead From Drinking Water

2 minutes

Jeff Kart

Contributor (i)



June 18, 2020 MEDIA CONTACT Kevin Stacey

401-863-3766

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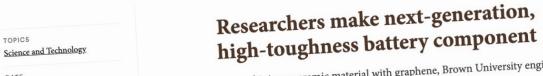
kevin stacey@brown.edu

**News from Brown** 

FEATURED EVENTS FOR JOURNALISTS Q





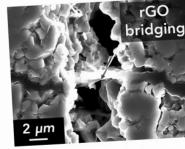


By combining a ceramic material with graphene, Brown University engineers have made what they say is the toughest solid electrolyte built to date.

 $\textbf{PROVIDENCE, R.I.} \ [Brown \ University] - A \ team \ of \ Brown \ University \ researchers \ has \ found \ a \ way \ to$ double the toughness of a ceramic material used to make solid-state lithium ion batteries. The strategy, described in the journal Matter, could be useful in bringing solid-state batteries to the mass market.

"There's huge interest in replacing the liquid electrolytes in current batteries with ceramic materials because they're safer and can provide higher energy density," said Christos Athanasiou, a postdoctoral researcher in Brown's School of Engineering and lead author of the research. "So far, research on solid electrolytes has focused on optimizing their chemical properties. With this work, we're focusing on the mechanical properties, in the hope of making them safer and more practical for widespread use."

The electrolyte is the barrier between a battery's cathode and anode through which lithium ions flow during charging or discharging. Liquid electrolytes work pretty well — they're



Research shows that graphene (rGO) can help prevent the propagation of cracks in ceramic materials used for battery electrolytes.



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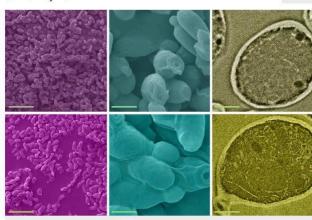
SEARCH NEWS

#### Could used beer yeast be the solution to heavy metal contamination in water?

A study shows that yeast, an abundant waste product from breweries, can filter out even trace amounts of lead.

David L. Chandler | MIT News Office June 13, 2022





In this image, A control group of yeast cells (top row) is compared to yeast cells after they have accumulated lead from contaminated water (bottom row) Scanning electron microscope (SEM) images







