



Glass strengthening and lightweighting for beverage packaging



Background

Glass bottles are relatively heavy and brittle. Many glass bottle companies have attempted to reduce the weight of their bottles by thinning the glass, resulting in lighter products. However, since glass weight reduction often compromises its strength, increasing the strength of glass is needed prior to lightweighting.

Processes for "glass tempering" (hardening) have been employed since the 1950s, to produce stronger, less breakable glass. Strengthening processes include thermal, mechanical, chemical hardening methods. These strengthening techniques can induce compressive stresses and avoid or repair surface flaws to improve mechanical performance of glass. For instance, in the chemical strengthening process, smaller sodium ions are replaced with larger potassium ions on the glass surface to enhance fracture resistance and durability. This method has produced glass up to 15 times stronger, more heat-resistant, stackable, and lighter than traditional glass.

PepsiCo's ongoing efforts to reduce plastic usage in its beverage packaging have led to an exploration of sustainable alternatives. Glass, already used as a single-use or returnable solution within PepsiCo's portfolio, presents an ideal candidate for further innovation. By improving the durability and reducing the weight of glass, this initiative would enable PepsiCo to offer an eco-friendly packaging solution that supports both its sustainability goals and its need for robust packaging solutions.

What we're looking for

We are looking for a superior substitute for the existing soda lime type of glass bottles. Specifically, we seek technologies that enhance the mechanical performance of both single-use and returnable glass bottles, and/or enable weight reduction without compromising strength, integrity, or durability.

Solutions of interest include:

- Glass strengthening technologies to improve mechanical performance
- Glass lightweighting beyond conventional design change.
- Coating solutions to heal (repair) microcracks

Our must-have requirements are:

- Compatible with carbonated beverages (pH 3-5) and water (pH 6-9)
- Low or no impact on recyclability

Our nice-to-have's are:

- Equivalent “end of life” stage as existing soda lime glass
- Lower greenhouse gas (GHG) emissions compared to current glass packaging options
- Low or no impact on shelf life, taste, or appearance of the product
- Preliminary knowledge on cost of commercialization
- Labeling and printing on glass should not be affected

What's out of scope:

- Conventional design changes for lightweighting

Acceptable technology readiness levels (TRL): Levels 5-9

1. Basic principles observed
2. Concept development
3. Experimental proof of concept
4. Validated in lab conditions
5. Validated in relevant environment
6. Demonstrated in relevant environment
7. Regulatory approval
8. Product in production
9. Product in market

What we can offer you**Eligible partnership models:**

- Sponsored research
- Co-development
- Supply/purchase
- Licensing
- Material transfer

Benefits:**Sponsored Research**

Funding is proposal-dependent, and typically ranges from \$25,000 to \$100,000. Preference will be given to an integrated team that has all of the capabilities needed to develop the model. PepsiCo is excited to partner with external researchers.

Expertise

Work directly with our team of scientists and engineers with deep experience in packaging, food science, and bringing new products to market at a massive scale.

Tools and Technologies

Testing available under Non-Disclosure Agreement (NDA).

Who we are

PepsiCo products are enjoyed by consumers more than one billion times a day in more than 200 countries and territories around the world. PepsiCo's product portfolio includes a wide range of enjoyable foods and beverages, including many iconic brands that generate more than \$1 billion each in estimated annual retail sales.

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