

**Title: Amorphous sugar materials as sustainable and scalable alternatives for short-term-use, rigid products**

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Abstract:

This presentation describes a new class of materials that uses small-molecule sugars, rather than polymers, as a renewable, non-toxic, and cost-effective matrix. The low hygroscopicity of the sugar supports a prolonged shelf-life, while plant-based additives combined with the amorphous matrix enables facile tuning of mechanical properties. Like plastics, this class of materials is lightweight and can be produced efficiently at low temperatures via injection molding, yet the materials emulate the rigidity and strength of ceramics and stones. The use of a small-molecule matrix allows the materials to be recycled repeatedly via a closed-loop process without loss of mechanical properties. At the end-of-use, these materials can be dissolved in water at a controlled rate, or composted in soil. For certain applications, versions of these materials are designed to be water-insoluble until an exterior surface coating is compromised. Thus, amorphous sugar materials are promising as environmentally friendly replacements for disposable plastics or ceramics in a variety of commercial products, satisfying many of the metrics for sustainable materials.