

Mesoscale Priority Research Direction

Making better foams

Opportunity

The material properties of a foam depend upon not the parent material properties, but pore size and distribution. Both the pore and structural components span a range of sizes, and the local structure of the foam material can act in many ways like thin films, with properties determined by both quantum constraints and macroscopic properties.

Meso Challenge

How does one determine foam properties given knowledge of the parent material?

How do we control strength, stiffness, flexibility, durability, and recoverability?

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Approach

We need to control, for a parent, the foam structure and processing, then apply bulk and nanoscale techniques such as AFM, x-ray radiography, crush/strength testing, and recovery testing (bounce-back). This will allow us to determine equations of state for foams with different foam structures but the same parent material and develop predictive behavioral models for new foams.

Impact

We use foams everyday but have no reliable prediction for how a foam will behave based on bubble size, parent material, or foam structure. Once we understand these parameters, we will be able to design new foams, with enhanced strength or better bounce back, for a wide variety of applications ranging from shoes to insulation to safety products.