Perfectly-Plastic Material

\[ \frac{\partial}{\partial t} \mathbf{F} \mathbf{S} \mathbf{F} \mathbf{F} \mathbf{F}_{\text{g,s}} = \mathbf{F} \mathbf{F} \mathbf{F} \mathbf{F}_{\text{g,s}} \]

Material Flow:

\[ F = \sigma_{\text{el}} / \sigma_{\text{v,m}} \]

Young’s and Bulk Moduli decrease drastically through Glass Transition allowing large deformations

Porosity as predicted by the model

Temperature & Pressure Profiles

Pressure Profiles

Expansion Ratio as Quality Parameter

Summary & Potential Applications

A fully coupled model for multiphase transport and large deformation during rice puffing was formulated, solved using finite elements and validated using experimental measurements.

- High temperatures are required to generate pressures and glass transition to puff the grain
- Rice starts to puff from the tip where it becomes rubbery. Pore formation within the kernels follows a similar trend.
- Large pressures are developed in the glassy regions near the core that are subsequently released when the material transitions to the rubbery state and puffs.

The model developed for rice puffing can be extended to many other puffing type processes and products e.g., using hot oil, gas puffing, extrusion, microwave puffing and starch based foamed plastics in the chemical process industry.