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Water Capacity of TufFoam

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Introduction

TufFoam is a Sandia-developed, closed cell polyurethane foam for insulation and impact force dispersion. Unlike similar commercially available foams, TufFoam does not require the carcinogenic compound toluene diisocyanate in the production process. Since properties of foams can change with saturation level, this study examines the capacity of TufFoam to absorb water.

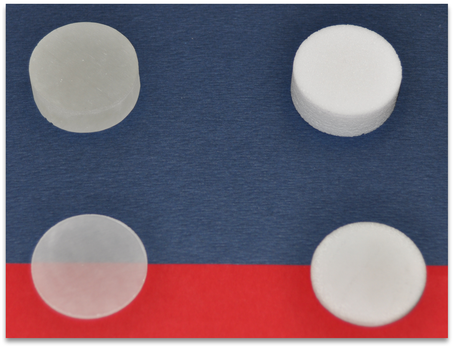
Procedures

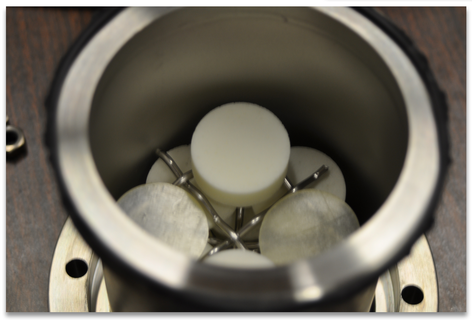
- Samples were weighed at initial, ambient condition and throughout the two week drying process. Samples were dried in ovens between 70 and 80°C.
- When weight loss slowed to 0.02% per day, dried samples were transferred to canisters with 100% relative humidity (RH). Three replicate disks of each type were tracked, as well as five additional completely skinned disks, for a total of 113 disks.

Conclusions

TufFoam takes about two weeks to oven-dry to steady state from ambient conditions of ~24°C and ~50% RH and loses ~1% of its mass. Samples subsequently gain water quickly, with one set gaining 3% of its dry mass in the first day. Weight gain is more dramatic for disks that are thiner, at lower densities, and with skin. Higher temperature causes faster initial weight gain, but tapers after the first week for low- and mid-density samples. Total eventual weight gain cannot be compared until the samples achieve steady state.

Samples of TufFoam (note that the high density disks are translucent)



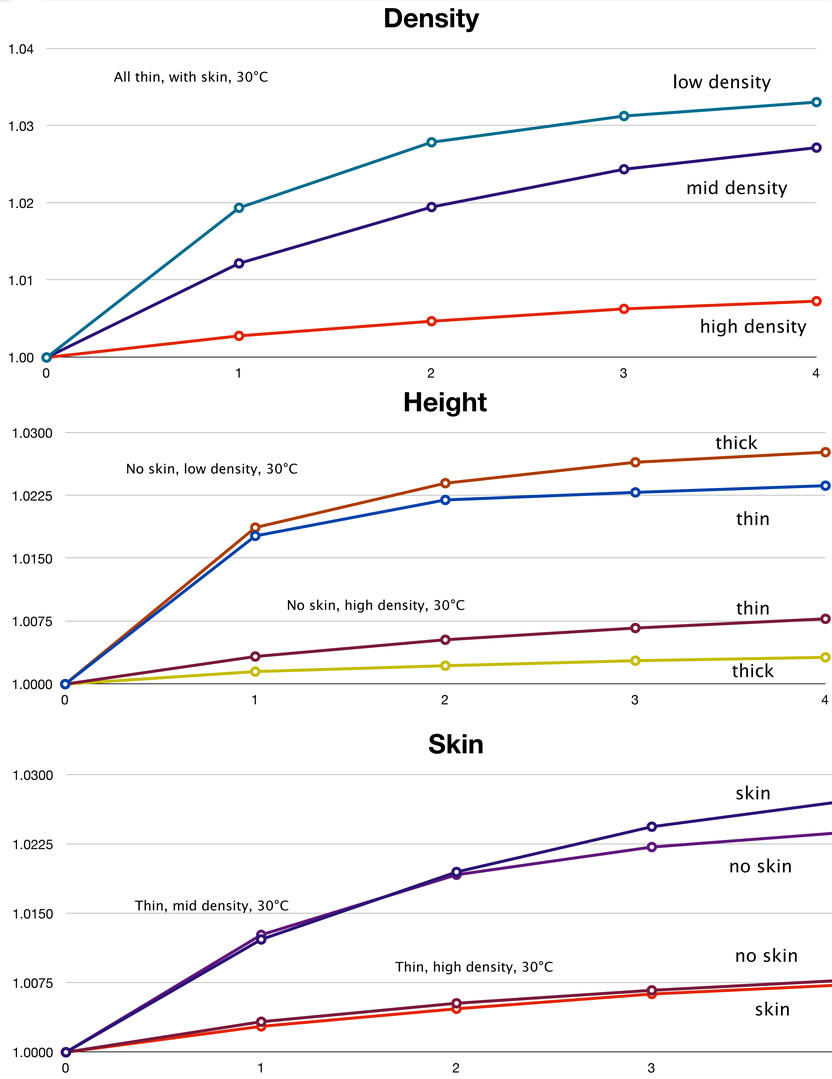


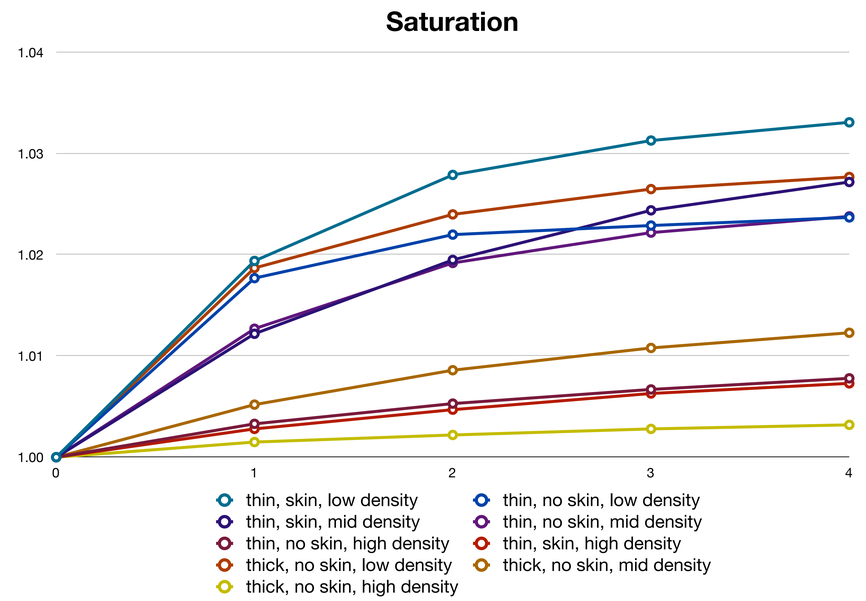
Canister with conflat flange and with stainless steel grating separating the samples

Variables of Interest

- **Density:** ~0.35g/cc, ~0.55g/cc, and ~1.2g/cc
- **Disk thickness**: 0.3 cm and 1 cm
- **Skin**: original exterior maintained and removed
- **Temperature at 100% RH:** 30°C, 50°C, and 70°

3 densities × 2 thicknesses × 2 skin conditions × 3 temperatures × 3 replicates = 108 disks





Future Work

- Continue collecting data until saturation.
- Compare mechanical and electrical properties of dry and saturated TufFoam.

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