Characterization of dimensional and morphological changes of cellular polymers during combustion.

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Many types of polymeric foams show a strong tendency to shrink and form liquid decomposition products during combustion. The complex, non-planar geometry of the burning objects and the eventual flow of burning liquid makes the design and interpretation of flammability tests for cellular polymers a demanding and involved task. New approaches to the characterization of the actual shape of the sample and the fate of burning liquids are needed to substantially improve both flammability testing and numerical simulations of foam combustion.

In this study, the effect of dimensional changes on the rate of gasification and burning of cellular polymers was studied under the well controlled experimental conditions of the NIST gasification device and the cone calorimeter. Attention was given to variations of the incident heat flux, the effect of convective heat transfer and its variation with flame stand-off, as well as the effect of short measurement times and instrument precision. Recommendations for sample size and test conditions are in preparation.

The flame spread rate of horizontally aligned foam samples is affected by the structural collapse of foams and the flow of burning liquid from the receding foam surface. The heat transfer from the flame defines the shape of the shrinking foam sample, whilst the geometry formed in turn affects the magnitude of heat transfer. The influence of this coupled effect on the flame spread rate was investigated for cellular polymers with different chemical composition and morphology. A combined approach of video recordings and 3D laser scanning was taken to characterize the flame shape and resulting shape of the polymer surface.