Abstract

Series of experiments was carried out with and without trench sidewalls on PMMA (Polymethylmethacrylate) samples in order to investigate flame spread physics influenced by a fuel geometry. It was determined that the so-called “trench effect” was investigated extensively only several decades ago where the main focus of the studies was on angles below 45 degrees. This research is mainly focused on the flame spread behaviour at steep angles between 50 and 90 degrees in a trench to expand upon previous studies found in literature. Video data analysis was the main tool for measurements, however, series of thermocouples were installed along the centerline of a sample as a point of comparison.

The results showed that the flame spread rate in a trench grows sharply between 15 and 30 degrees, but then remained almost constant at angles from 50 to 90 degrees even if the height of sidewalls were varied. This behaviour is completely different when sidewalls are absent since the flame spread rate demonstrated a gradual growth with an increase of inclination angle. Also, the presence of sidewalls greatly influences both flame spread rate and its structure that was observed during the tests. Flame and pyrolysis front shapes were compared and discussed in detail where possible influential factors on the contour were mentioned.

In addition, the findings from this work can contribute to a better understanding of the flame spread topic in general and propose some questions for further research.