

ABSTRACT

Social gathers in India and many other countries are frequently held in a *shamiana*. Fires in such structures are regularly reported and result in high casualties. The understanding of fire dynamics of a *shamiana* fire can help improve its fire safety. *Shamianas* are made of fabric panels fasten to a metal/wooden frame. A series of experiments have been performed to study the propagation of flames in fabric panel(s).

The first set of experiments were with different height of vertical panels for both upward and downward flame spread for both cellulosic and non-cellulosic materials. The next set of experiments were for horizontal panel burning with edge and center ignition. In the final set of experiments, the effect of the burning of a vertical panel on the burning of a horizontal panel was investigated.

The vertical single panel experiments are done for five heights of 500, 750, 1000, 1250, and 1500 mm, but the same width of 500 mm. Ignition was at the center of the lower edge and flame spread parameters like flame height, flame width, char height, and char have been measured with an IR camera and thermocouple. Flame propagation and non-dimensional mass loss were obtained from this data. Relative mass loss, relative temperatures, and relative times were defined and for comparing data, and scaling criteria were developed. In experiments with polyester fabric (PET material), it was observed that the flame spread rate was much slower and random. The nature of these materials results in detachment of the burning globules from the fabric which can spread fire to materials on the ground.

With the horizontal orientation of the fabric panel and ignition at the fabric center, it was observed that the flame occurs either lower or both sides of the fabric. The duration of contact between the ignition flame and the fabric determines the nature of flame. If the duration is more than 3-5 s both side flame occurs and if the duration is less than 3 s then flame stabilizes only on the bottom side of the fabric. In the experiments, temperature profiles at different locations were measured and with thermocouples and IR camera. The burning rate of fabric was obtained from mass loss history. The data showed that one side burning was much slower than the both side burning, but the generation of toxic gases was much higher in one side burning. The failure of tie of a panel occurs when the fabric around the tie is burnt which causes the fabric to break at the tie and fall down also tested. The result is accelerated fire spread.

In the two panel tests, flame propagation from the bottom edge of the panel to the horizontal panel was studied. The height of the vertical panel has been varied (500, 750, 1000, and 1250 mm) but the size of the horizontal panel was same (750 mm). The temperature profiles under and over the horizontal panel were measured as also mass loss history. The results of the two-panel tests suggest that there is no significant difference in the duration for flame transfer from the vertical panel to horizontal panel for different heights of the vertical panel.

The *Shamiana* survey was conducted to collect information about the current trends and services in *shamiana* making. Several aspects have been documented, and it also points out to the need for improving fire safety standards.

Keywords: *Shamiana*, fabric panel, fire propagation, burning, two-panel burning.