ABSTRACT

Ignition is a key parameter for fire risk assessment, since it governs the flame spread and, therefore, the fire growth. In the present work, an experimental study on PMMA samples exposed to transient heating is performed, which is a more realistic approach in comparison to real fires. The aim of this thesis is to understand the parameters involved in the ignition of solids and how these parameters vary with different heating rates. In order to do so, black PMMA samples measuring 85 x 85 x 25 mm were exposed to three different linear heating rates - 40, 60 and 80 $W/m^2.s$ - in the Fire Propagation Apparatus (FPA). The parameters compared were critical mass loss rate, critical surface temperature, ignition delay time, incident heat flux at ignition and surface losses. Also, experiments using constant incident heat fluxes were also performed in order to compare with the literature. The mass loss rate was found to increase with the heating rate, and this trend is reported in previous works. However, the deviation between the experiments was significantly high. The average values were 3.69, 3.83 and 4.06 $g/m^2.s$ for the heating rates of 40, 60 and 80 $W/m^2.s$, respectively. The maximum value was 5.73 $g/m^2.s$, whereas the minimum was 2.73 $g/m^2.s$, both at a heating rate of 80 $W/m^2.s$. The critical surface temperature was observed to increase with the heating rate, which is in accordance with previous works. However, the temperatures were quantitatively lower than the ones reported in the literature. The maximum value for surface temperature was 303.94°C at the heating rate of 80 $W/m^2.s$, whereas the minimum was 226.91°C at the heating rate of 40 $W/m^2.s$. Ignition delay times decreased with the heating rate, whereas the incident heat flux at ignition increased. The net heat flux and the surface losses were found to increase with the heating rate, and an average value of 6 kW/m^2 was found for the former and 31.75 kW/m^2 for the latter.