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The Effect of Thickness on Plywood Vertical Fire Spread

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Abstract

In order to study the effect of plywood's thickness on vertical fire spread, small-sized experiment is conducted to study flame front position,pyrolysis front position and burnout front position at the thickness of 2,3,6 mm respectively. Through the effect of sample thickness on flame spread rate, flame height and pyrolysis height are analyzed,the experimental results show that the thickness has obvious influences on the process of the plywood vertical fire spread. Flame front position, pyrolysis front position and burnout front position, those three increases with the decrease on the sample thickness, which is consistent with the trend of flame spread rate with thickness. In the process of vertical combustion, flame height and pyrolysis height aren't stable figures, but the change with time shows that the figures increase firstly and then stabilize. Flame height and pyrolysis height increase with the decrease of specimen's thickness.

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Keywords: plywood, thickness, vertical flame spread, combustion characteristic parameters

Nomenclature

Xf	Flame front position of (cm)
Xp	Pyrolysis front position of (cm)
Xb	Burnout front position of (cm)
Hf	Flame height of (cm)
Hp	Pyrolysis height of (cm)
a	Slope
b	Intercept
R^2	R-Square

1. Introduction

With the reform and opening up and the continuous boost of the economy, the construction industry has been enjoyed rapid development. Plywood is widely used in interior decoration because of its beautiful look, high performance and other advantages. According to the combustion characteristics of materials, the fire of plywood is categorized to the Class A fire [1].This material is easy to be ignited and spread rapidly, therefore it is easy to lead to great fire risk. From this we can see that it is very important to study the vertical fire spread of plywood.

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In china, some previous researches[2-7] related to timber fire focused on the combustion characteristic. By simulation experiment, Xi-shi WANG carried [8-9] out a dynamic measurement of the fire spread characteristics of wood surfaces under different working conditions. He found that the rate of fire spread increases with the increase of wind speed within a certain wind speed range. Through experimental studies, Li LI[10] found that the fire spread rate of plywood in a stationary environment depends mainly on the inherent characteristics of the sample. Along with the wood combustion has been studied extensively by scholars [11-13]abroad, Kokkala Matti[14] studied the vertical fire spread characteristics of large-sized wood products. From some studies, he found that for particle board and wood panels on an insulating substrate flame spreads upwards, retreats and then spreads upward again. Xu Q [15] studied the burning behavior of small-scale wood crib by a serial of cone calorimeter tests. They found that the heat release rate curves of these small wood cribs are different due to porosity factor, showing that the control condition switches from one to another.

A great number of scholars obtain the fire spread model under the corresponding conditions through studying the fire spread rate of the wood. But for the parameters of combustion characteristics of wood such as flame and pyrolysis during vertical fire spreading, there is a lack of experimental research. Based on these problems, we have conducted a small-sized experimental study by controlling the thickness of the sample. Through the experimental study, we measure flame front position, pyrolysis front position and burnout front position in different thicknesses. Through the data, we can get results for the effect of sample thickness on flame spread rate, flame height and pyrolysis height.

2. Experimental setup and procedure

2.1 Experimental apparatus

In order to study the effect of the plywood's thickness for vertical fire spread, small experiments are carried outwith using vertical combustion experimental apparatus. The schematic diagram of the experimental apparatus is shown in Figure 1. Experimental devices mainly including scaffold, high-definition SLR camera, infrared camera, computer and other devices.

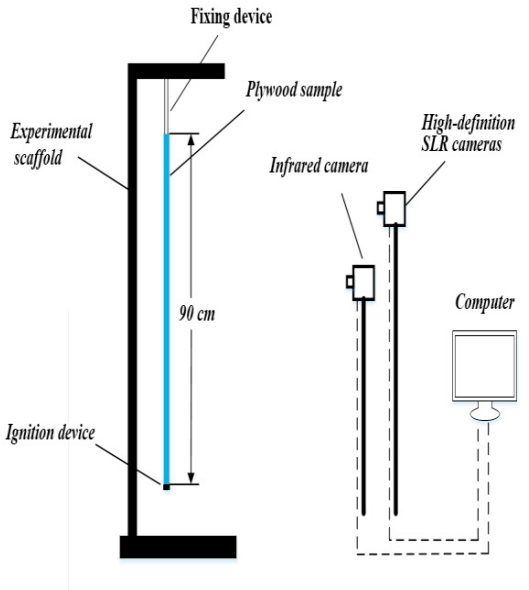

Fig. 1 Schematic diagram of experimental apparatus

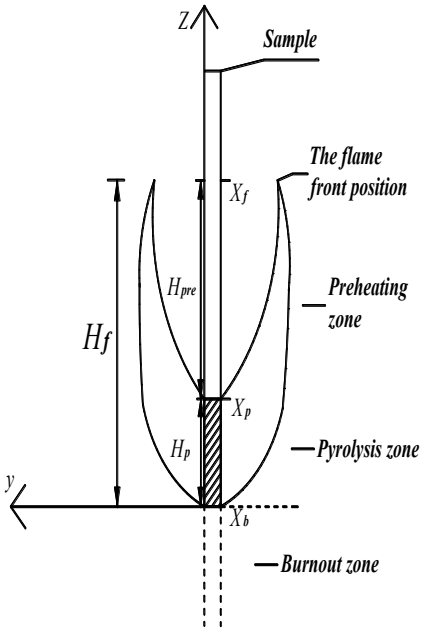

Fig. 2 Schematic diagram of flame

2.2 Experimental materials

The experiments above are small-sized experiments, adopting the most common plywood on the market which named five-plywood. The thickness of the most common plywood in the market is 2, 3 and 6 mm respectively, in order to meet the

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