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**Effects of Time-Dependent Heat Fluxes on Pyrolysis and Spontaneous**

 **Ignition of Wet Wood**

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# ABSTRACT

This work investigates experimentally and theoretically the effects of time-dependent incident heat flux (HF), which is more reasonable in fire-like environment, on thermal degradation process of wet pine wood. A feedback method was utilized to generate a time-dependent HF by controlling the output power of radiative heater, namely *q*in*=αtβ*, and both quadratic and linear heat fluxes are focused in this study. Comparison between the measured varying heat fluxes and designed values indicates that this method provides high accuracy necessary. Measurements of mass loss rate, temperature distribution at different depths of material and ignition time were implemented in the tests to examine the influence of time-dependent heat fluxes. The results showed that the mass loss rate is affected significantly by the changed heat flux compared with constant scenario. The critical mass flux, which keeps almost unchanged, can be employed as the ignition criterion due to the fact that the ignition temperature increases with increasing HF, which also certifies the conclusions of other researchers. The heat penetration layer is restricted to a thinner depth with larger *α* and *β*. A simplified theoretical model is used to predict the surface temperature before ignition and good agreement exists between the experimental and theoretical results. Furthermore, a linear relationship was found between ignition time and *α*−2/(1+2*β*), which is also validated by the experimental data and is reexamined by the constant circumstance.

This work investigates experimentally and theoretically the effects of time-dependent incident heat flux (HF), which is more reasonable in fire-like environment, on thermal degradation process of wet pine wood.Comparison between the measured varying heat fluxes and designed values indicates that this method provides high accuracy necessary. The results showed that the mass loss rate is affected significantly by the changed heat flux compared with constant scenario. Measurements of mass loss rate, temperature distribution at different depths of material and ignition time were implemented in the tests to examine the influence of time-dependent heat fluxes. The results showed that the mass loss rate is affected significantly by the changed heat flux compared with constant scenario.

**Keywords:** Time-dependent heat flux, pyrolysis, wood, ignition time.

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