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The Study on the Temperature Growth in Compartment for Development of Fire Model

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Extended Abstract

Various protective measures and research are being conducted to prepare for fire accidents that occur in buildings. Currently, the most common method is to use fire resistance performance evaluations and standards for the structural members of buildings to prevent collapse during a fire, thereby reducing human casualties and property damage. However, the fire model used in furnaces for fire resistance evaluations was developed in the 1990s and does not reflect various fire characteristics due to the technological limitations of that time. The standard fire model, represented by the EURO Code, has limitations as it imposes restrictions on the floor area and height of compartment spaces [1]. This model assumes that, during a fire, the entire compartment burns simultaneously and that all combustible materials within are completely consumed. As a result, it does not account for the characteristics of large compartment where the temperature rises and cools repeatedly as the fire spreads. To address these issues, various fire models are being researched. A notable example is the "Travelling Fire" model [2] and [3], which reflects the uneven burning state in compartment spaces more realistically. This model depicts local fires spreading across the floor of the compartment space.

In this study, temperature changes inside a compartment of 5.0(L) × 25.0(W) × 5.0(H) m were measured using six ethanol containers with an area of 0.2 m^2 each for evaluation fire characteristics in a large space different from the existing compartment model. Two methods were employed: simultaneous ignition and ignition with intervals. According to the experiment, the maximum temperature measured was 229.7°C in the case of simultaneous ignition and 172.7°C in the case of ignition with intervals. The average temperature difference based on the measurement location was 56.6°C. The differing temperature changes observed in the combustion experiments, despite the same compartment size and combustible materials, highlight the necessity of developing fire models that match combustion characteristics. In compartment, the spread of a fire is initially determined by the combustion characteristics of the combustible materials and subsequently by the ventilation characteristics of the compartment, which influence the fire's growth [4]. However, in large compartment, there is often a substantial amount of oxygen available for combustion, which may not be adequately reflected in current fire models. For example, atrium-like spaces typically have fewer combustible materials inside, while warehouses contain a large amount of combustibles. Therefore, it is necessary to develop fire models that match the characteristics of different compartment spaces to address the complex and diverse fire hazards effectively.

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