# Experimental study on fire smoke movement in a multi-layer and multi-room building

Maohua ZHONG [a,b] Tiemin LIU [b] Xing WEI [a,b] Peide LI [a]

[a]State Key Laboratory of Fire Science, University of Science and Technology of China, Hefei, Anhui, 230026 P. R. China

[b]National Center of Safety Science and Technology, State Administration of Work Safety, 17 Huixin Xijie, Chaoyang District, Beijing, 100029 P. R. China

## Abstract

With the stable and fast development of China economic, high-rise buildings were set up more and more. According to the statistical data, the number of high-rise buildings being used exceeds 20000, and there are over 300 buildings whose height is in excess of 100m in China. As a mass of combustibles used in high-rise buildings, fire probability is high. Meanwhile, human evacuation in high-rise buildings during fire periods is more difficult than those in common buildings. In 2002, 15270 fires happened in high-rise buildings, the death and the direct economic loss are 614 persons and 0.228 billion RMB respectively in China. Especially after “9.11” event, how to improve fire prevention of high-rise buildings is an important project for building fire researchers.

The wind pressure occurred in high-rise building fire induces fire smoke spreading

to up layer or down layer and every passages such as aisles, stair wells, pipeline well and elevator well. If the fire is out of control in its initial stages, fire columniation like tall chimney can be formed and it is very dangerous for human evacuation.

Generally, there are two methods of studying multi-layer and multi-room building fire: simulation and experiment. Computation simulations include zone simulation, field simulation and network simulation. Common used simulations have CFAST, ASET, FPETOOL, HAVEARD, CCFM, FIRST and FZN. The main methods of experimental study are small-scale tests and full-scale tests. Liang and Chow studied fire smoke movement in buildings using nonlinear dynamics. Luo and He studied flashover fire smoke movements using field model and two-zone model in a full- scale multi-room single level building, and their predicted temperatures from the CFAST fire model agreed well with the experimental results in most area.

In this paper, we present the experimental study on fire smoke spread in a multi-layer and multi-room building. These tests were done in the half-scale (1:2) multi-layer and multi-room building in State Key Laboratory of Fire Science, University of Science and Technology of China. The changing of air temperature, air pressure, concentration of every smoke composition and fire smoke movement velocity using different fire sources were discussed and some conclusions were reached.

**Key words**: Experimental study, multi-layer and multi-room building, smoke spread, building fire.