Collaborative Experiment of Interior Lining Materials

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Development of a rational evaluation method of interior lining materials is one of the problems of internationally common interest in fire safety engineering. Most of the industrialized countries have their own standards and testing methods on fire safety performance of lining materials; however, the conventional evaluation methods do not always represent fire growth mechanisms in actual building fires, probably since fire growth mechanisms were only poorly understood when these evaluation methods were developed. Recently, Nordic countries have started a research program to develop some rational testing methods of interior lining materials as preparation for the planned European market unification in 1992. Adoption of combustion models of lining materials in room fire computer models has been attempted at NIST. Also in Japan, development of a performance based evaluation method of interior lining materials is an urgent necessity, since, from a scientific viewpoint, the present Japanese standard is significantly based on whether combustion takes place or not, and as its result combustible materials tend to be eliminated from the market of lining materials.

Most of the current studies related to the evaluation of interior lining materials are based on some mathematical modeling. Recent work on wall fires by Saito, et al., describes flame spread as a function of the height of flame from pyrolysis zone which is further determined by the mass consumption rate of the fuel. This model seems to be consistent with the basic idea of the treatment of wall fires in the FIRST, in which wall fire is characterized by mass burning rate. For room configuration, Karlsson proposed a model of fire growth on lining materials, and was able to explain experimental results on a few specific materials using his model. His model is also based on the concept of flame spread as a result of inert heating of the material surface to an ignition temperature. Hasemi has also proposed a model of wall flame spread to explain flame spreading velocity from material properties.

Each model of fire spread has to be validated against experiments in realistic conditions if it is desired to serve as a scientific basis for evaluation methods. However, the major problem in advancing the scientific approach in this field is the fact that every group is too small and research facilities of each group are quite limited. Probably, it is difficult for every group to carry out all steps from basic property measurements to full scale experiments or from basic analysis to comprehensive computer models. Necessity and utility of some collaboration or coordination in this field arises from this circumstance.

At the last UJNR meeting in Tsukuba, Quintiere and Hasemi discussed the possibility of collaboration between NIST and BRI, and the visit of Dr. Parker of NIST to BRI for heat release analysis of wood was very beneficial and incentive to BRI. During his stay at BRI, it was pointed out that full scale wall fire experiments using the BRI's new radiant panels (approx. 2.5m wide and 3.2m high) as the heat source for external radiation would be useful for the validation of various models of wall flame spread and for the accumulation of data as a basis for the further development of the mathematical models.

In the FY 1989, several large scale wall fire experiments are planned, using this facility. The specimen will be PMMA and plywood (Douglas fir). Upward and downward flame spread will be observed for the range of external radiation approximately 0≈10 kW/m^2. Mass loss rate, surface temperature and flame height can be measured using the present BRI experimental apparatus. The experiments will be continued and extended if the FY 1990 budget for this program is approved.