The outline of the Japanese style cone calorimeter test for the building materials

- And, some examination items in our laboratory -

1. The revision of the building Standard Law.

The Construction Standard Law was revised drastically in 1998.
The purpose of taking the greater part of the revision was three heads of the following.

(1) Deregulation (the decrease of the labor).
(2) International harmonization (the active adoption of the international standard).
(3) A performance-based regulation (engineering like performance index is introduced. It cuts down a specifications regulation.) .

2. The examination of the test method.

The examination of the test method was done by administration as a preparation for the revision of the Building Standard Law in 5 years from 1993.
The test of the building materials was decided to be replaced with the method based on the international standard from the old style method by this.

Then, it could be considered that the combination of the following three examinations was ideal to evaluate the fire preventive material.

(1) Full scale: The room corner test.
(It can get much information. But, it is difficult, and more costly.)
(2) Intermediate scale: The model box test.
(It can get good information. But, it is a little difficult, is also costly. It is called a doghouse test.)
(3) Bench scale: The cone calorimeter test.
(It is hard to get the information as a building material. But, it is easy to carry out.)

However, as for (1) and (2), all preparation is not ready yet.
Because of this, the cone calorimeter test, which the test condition and a decision item were set up to the Japanese way, has been enforced from June 2000. (On a temporary basis?)

3. Japanese style cone calorimeter test.

3.1 test condition.

Incident heat flux is set at 50kW/m^2.
Heating time in the test was determined based on the classification level of each fire preventive material.

(1) The noncombustible material : twenty minutes .
(2) The semi noncombustible material : ten minutes .
(3) The fire retardant material : five minutes .

3.2 Standard for a decision.

The test is done on one material three times.
Three items of the following do the decision of the test.
The case that it was completely satisfied in the entire test becomes a success.

(1) The total heat release should be less than 8MJ/m^2.
(2) The maximum heat release rate should be less than 200kW/m^2; but not longer than ten seconds.
(3) There must not be any cracks or holes on test specimen at end of the heating.

3.3 The Japanese style / Difference from ISO5660.

(1) The quantity of heating and test time are being decided. There are no relations with the conditions of the combustion.
Even if it is when an ignition doesn't occur and when it appears that combustion occurred in a short time, the heat release rate is obtained from the start of heating, and continued until the end of heating.

(2) Usually, there are a few heat releases of the specimen.
In this situation, higher precision and stability are required by the measurement of oxygen concentration.

(3) The opening of the test specimen is checked by visual observation.
After heating is finished, the test specimen is taken off from the apparatus at once. Then, the test specimen is checked for openings, if they go through the material.

4. Examination items in our laboratory.

A cone calorimeter was introduced in April 1999, and the testing was started in our laboratory. Then, the Japanese style test was started in June 2000.
After that, some problems have been identified in our laboratory as follows.

(1) Base line measurement.
It is working to measure oxygen concentration steadily for twenty minutes.
Measurement is non-scrubbed by using the analysis meter of CO_2 and CO. Then, an equation uses Annex F of ISO5660/Part 1.
The calculation accuracy of the heat release rate takes an influence by the way of deciding the initial value of oxygen concentration.
A total heat release rate for 20 minutes changes as much as about 0.5MJ/m^2, when the initial value of oxygen concentration changes 0.001%.
It is considered that the measurement time of oxygen concentration initial value be extended by in about three minutes, for the accuracy improvement.

(2) Correspondence to the material by heat deformation.
The conclusion has not yet been reached though there is a request to coping with the fireproof paints and so on that intumesces or foams when it is heated.
In this case, there is no effect in the way of winding the material with a metal lattice or wire.
The examination can be continued if the test specimen is installed in the lower position. But, a heating condition's being disturbed due to intumescences of the surface of the test specimen isn't avoided.

(3) Maintenance.

Considerable efforts are required to make the test repeatedly stable.
For example, cleaning of regular gas sampling systems, sufficient warming-up of machine and reliable adjustment of the analysis meter.
It is important to exchange a filter and a desiccant each day or time of testing, too.

5. About the future.

(1) Now, a committee is being established to make the Japanese Industry Standard of the model box test and the cone calorimeter test. JTCCM has joined that committee, too.

(2) We are looking for the standard test specimen that is easier to use and that precision is better except for black PMMA board.

(3) We are ready to welcome any advice to make the test more reliable and easier.

October 2001.
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Clarification obtained from Prof. Hasemi (Waseda University, Tokyo)

"The maximum heat release rate should be less than 200kW/m^2; but not longer than ten seconds" means that specimen is allowed to exceed a HRR of 200 kW/m^2, but for no more than 10 seconds.

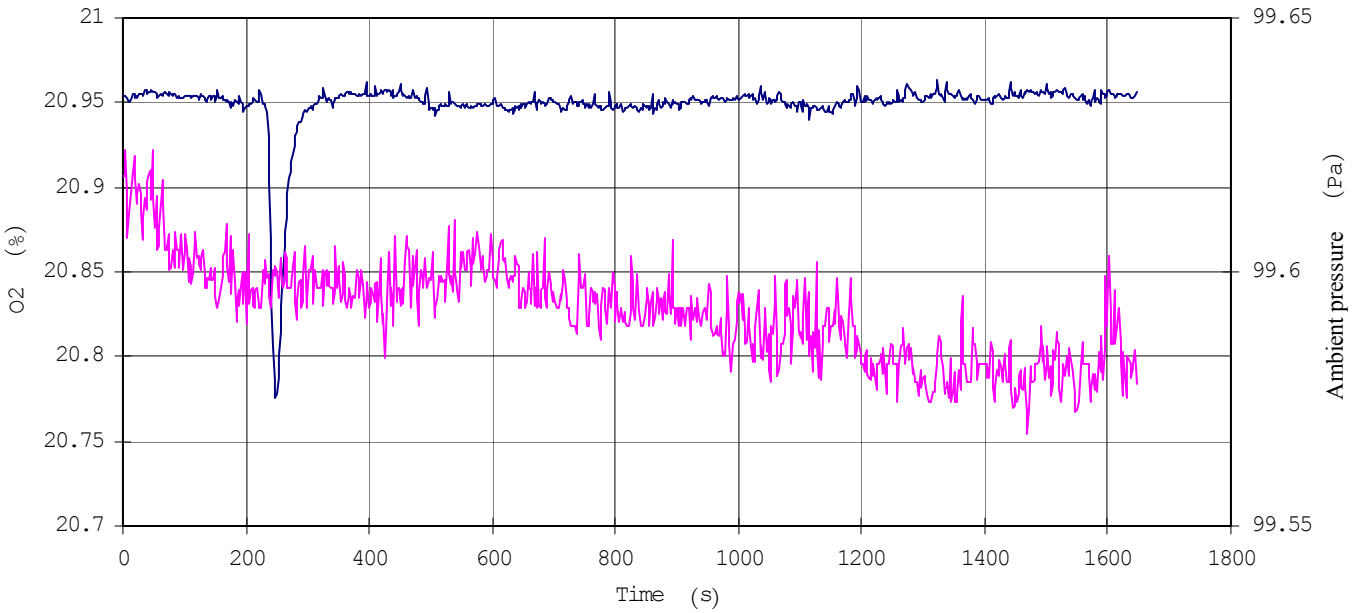

Fig. 1 Oxygen value and Ambient pressure curve

(Specimen : Painted steel sheet)

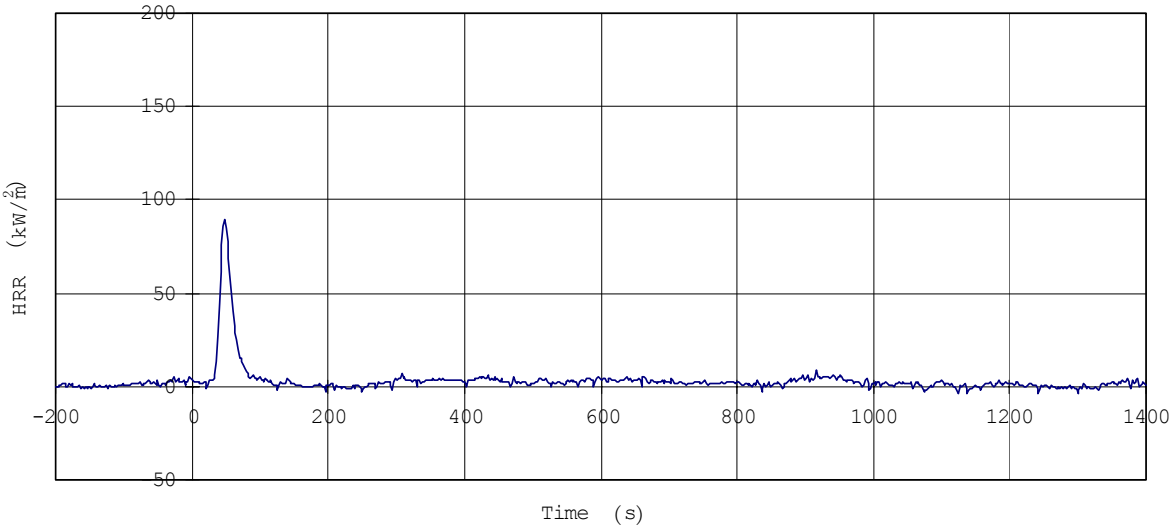

Fig.2 Heat release rate curve

(Specimen : Painted steel sheet)

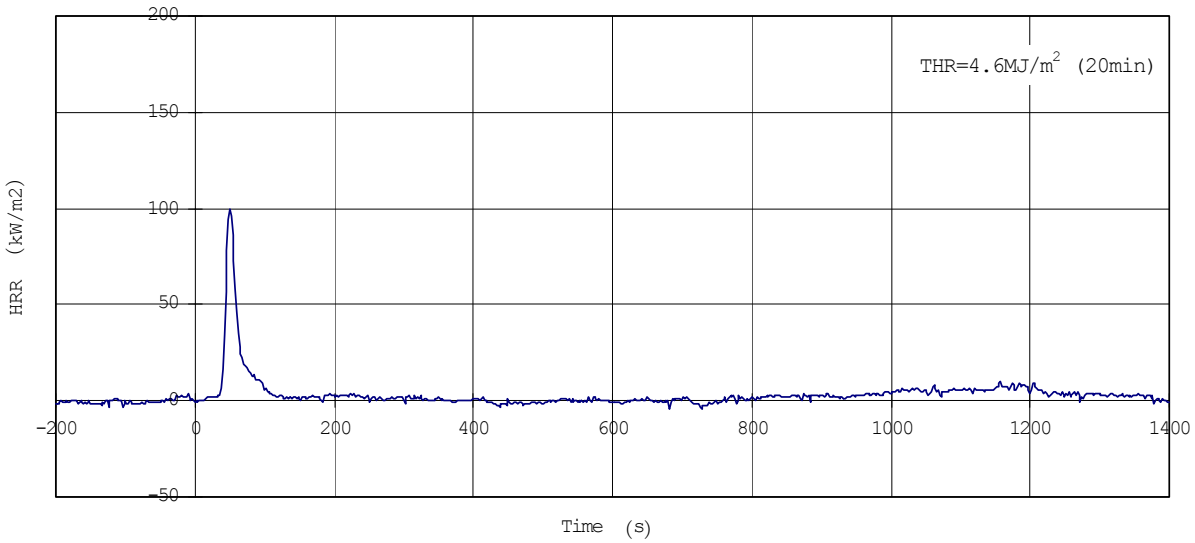

Fig.3 Heat release rate curve
(Specimen : Decorated gypsum board)