Laboratory Experiments

Thomas Steinhaus
&
Wolfram Jahn

Contents

- ***Ignition experiments*** *(pre full scale)*
- ***Tests for use as fire model input***
- ***Fire model input examples***
  (Chapter 6 of the proceedings)

Tests for use as fire model input:

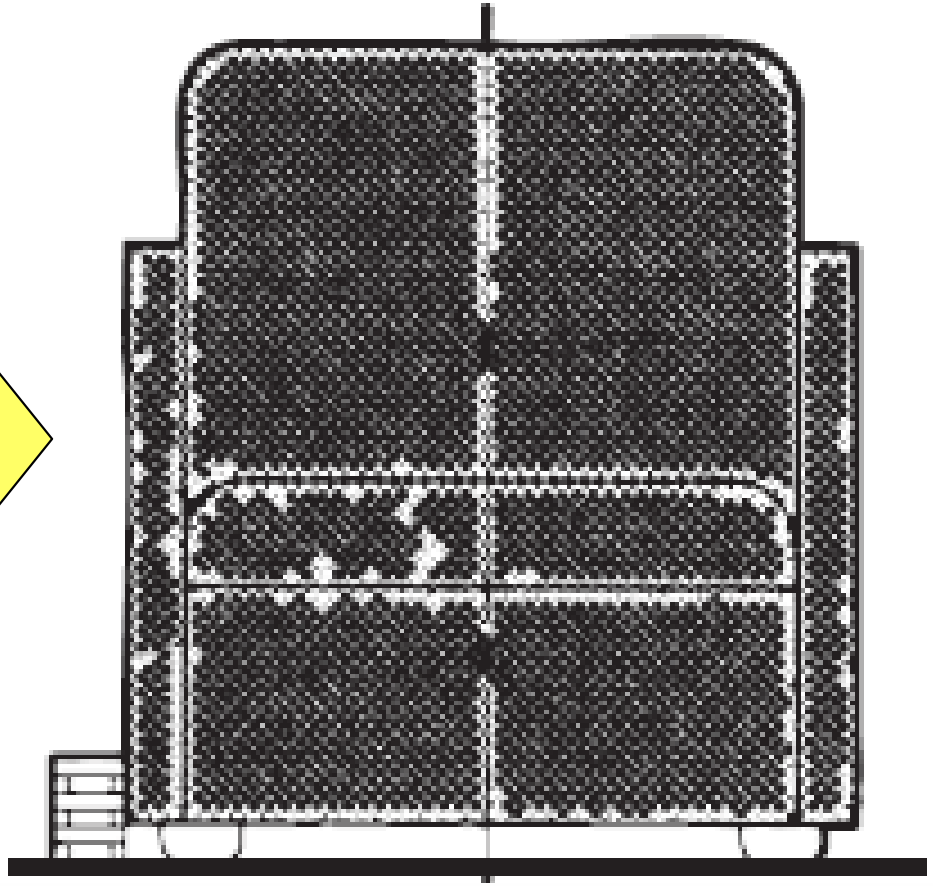
Sofa in Dalmarnock

Furniture and Furnishings (Fire Safety) Regulations

(from 1988 amended in 1989 and 1993)

BS 5852

Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources



Source: BS 5852:2006 (Figure 14b Model position for ignition source at floor level)

Ignition experiments:

effective fire barrier

Ignition experiments

Ignition experiments:

overcoming the fire barrier

Contents

- ***Ignition experiments*** *(pre full scale)*
- ***Tests for use as fire model input***

Tests for use as fire model input:

What do fire models need?

"Fire models require some sort of an input with respect to 'what' and 'how' a object burns!"

Common approaches how this is done are:

- ***steady state*** *heat release rate*
- ***"t^2 fire"*** *(HRR curve follows a time dependant parabolic growth curve)*
- *Heat release rates from* ***fire experiments***
- *Fire spread by means of material ignition as a function of* ***critical heat flux for ignition***
- *Fire growth purely based on the* ***thermophysical properties*** *of the materials involved*

Tests for use as fire model input:
Test description

Small samples - cone calorimeter

- *Heat release rate [kW/m^2]*
- *Critical heat flux*
  by exposing the samples to different heat fluxes in the cone calorimeter starting with a low heat flux and increasing it until piloted ignition occurred.

Larger items - laboratory hood equipped with an calorimeter equipment

- *Heat release rate [kW]*

Tests for use as fire model input:

Particleboard (wood) in Dalmarnock

Particleboard (wood)

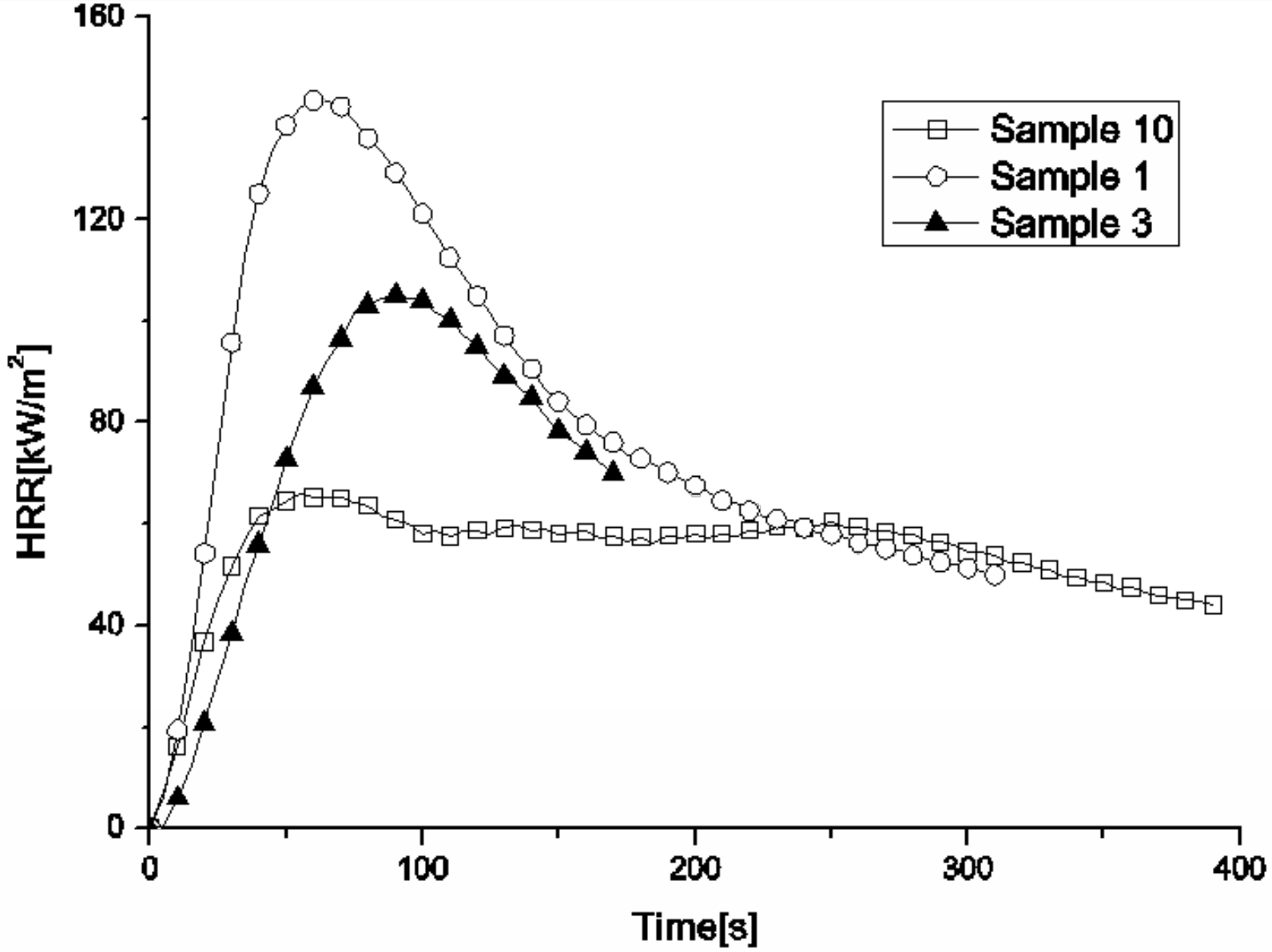
Tests for use as fire model input:

Particleboard (wood) Critical heat flux and time to ignition

Sample	Heat Flux	Time to ignition
[#]	[kW/m^2]	[s]
5	10	-
4	12	-
2	16	-
6	17	-
7	18	-
8	18.5	-
9	19	-
11	19.5	-
10	20	325
3	22	250
1	28	180

Tests for use as fire model input:

Particleboard (wood) HRR curves

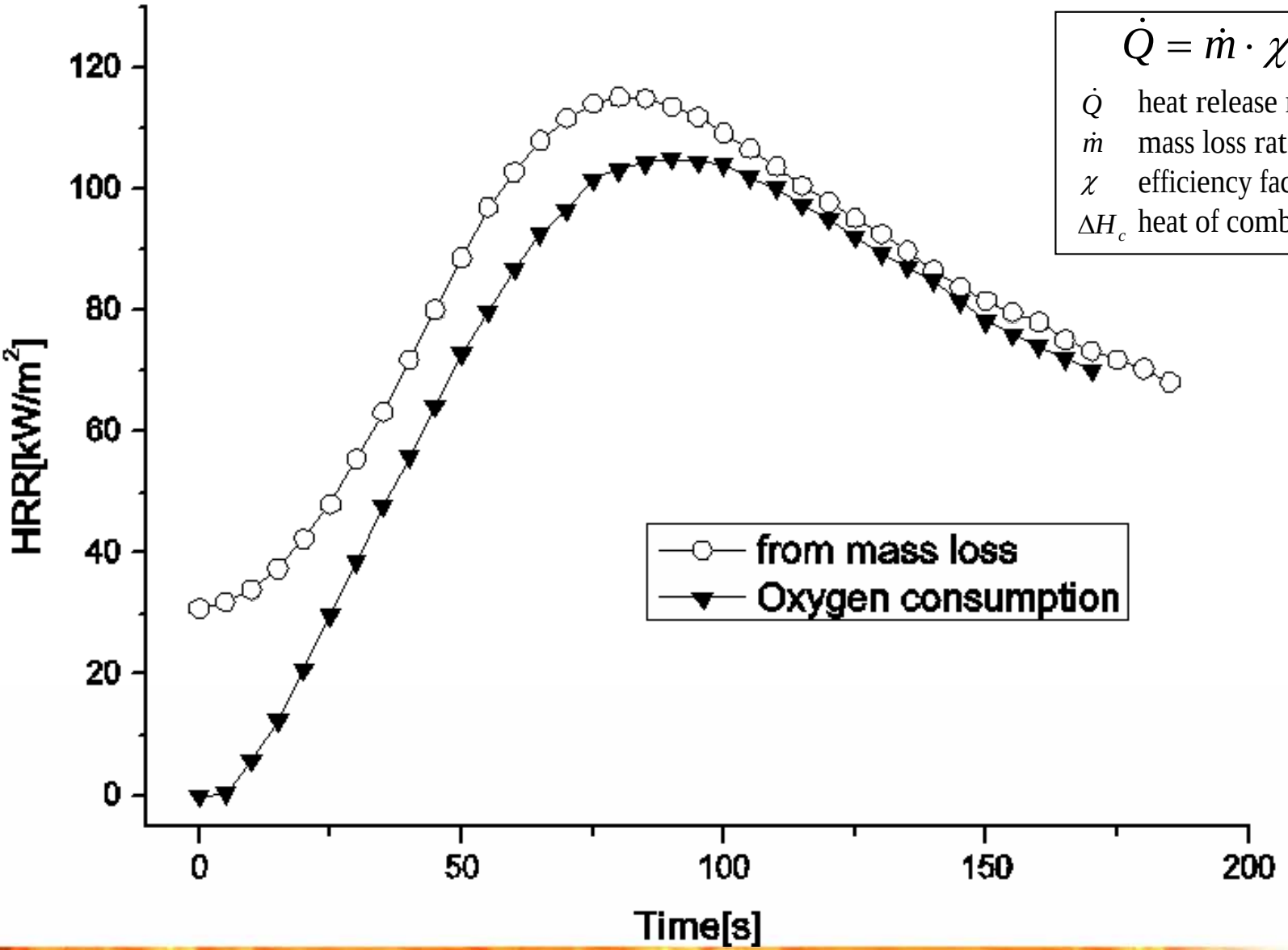


Tests for use as fire model input:

Particleboard (wood) HRR curve comparison

$$\dot{Q} = \dot{m} \cdot \chi \cdot \Delta H_c$$

$\dot{Q}$	heat release rate [kW/m2]
$\dot{m}$	mass loss rate [kg/s]
χ	efficiency factor [-]
ΔH_c	heat of combustion [MJ/kg]



THE UNIVERSITY OF EDINBURGH

Tests for use as fire model input:

Plastic Samples (Keyboard) in Dalmarnock

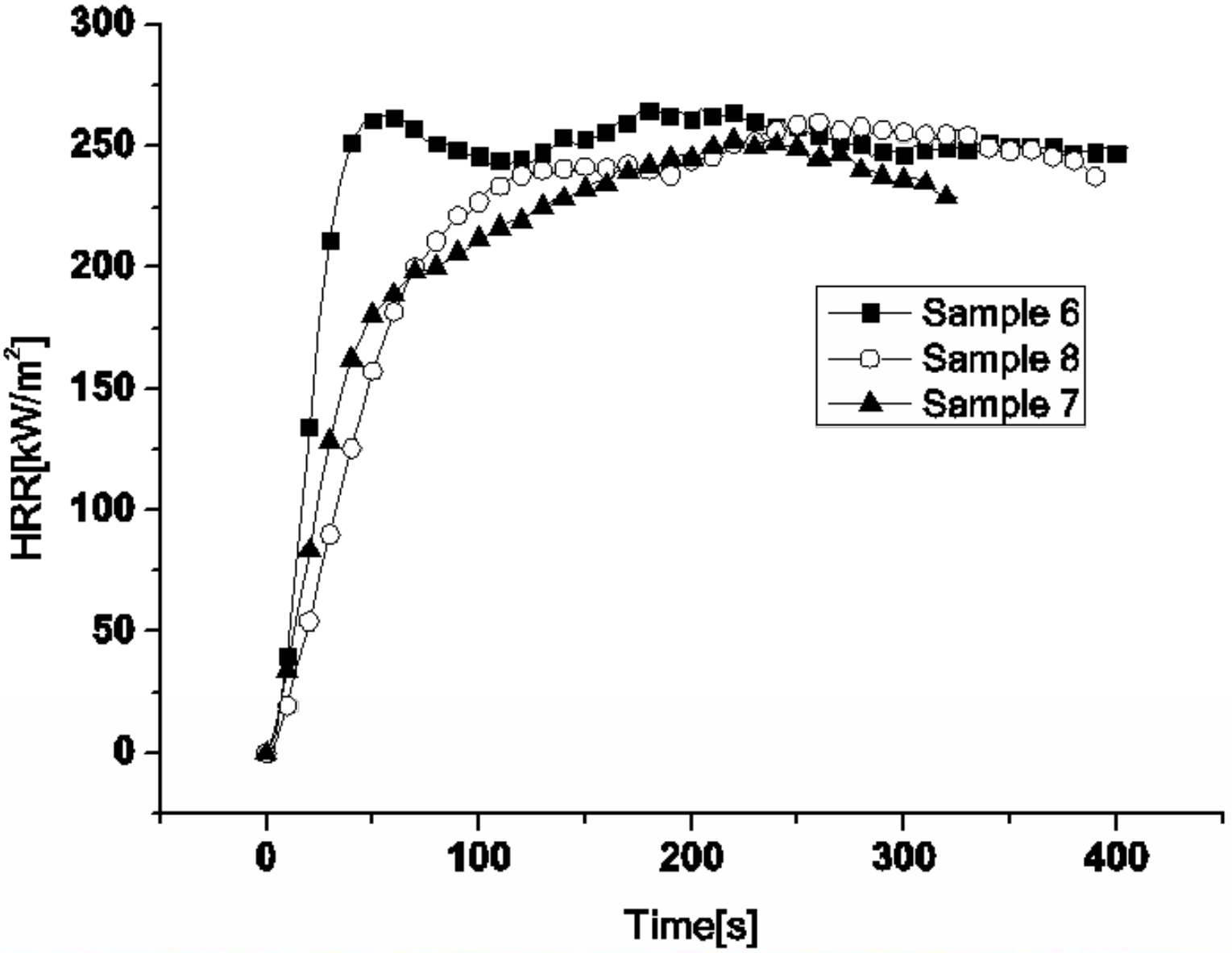
Tests for use as fire model input:

Plastic Samples (Keyboard) Critical heat flux and time to ignition

Sample	Heat Flux	Time to ignition
[#]	[kW/m^2]	[s]
4	13	-
1	13.7	-
2	14.1	-
7	14.35	481
8	16.7	274
6	18.6	330

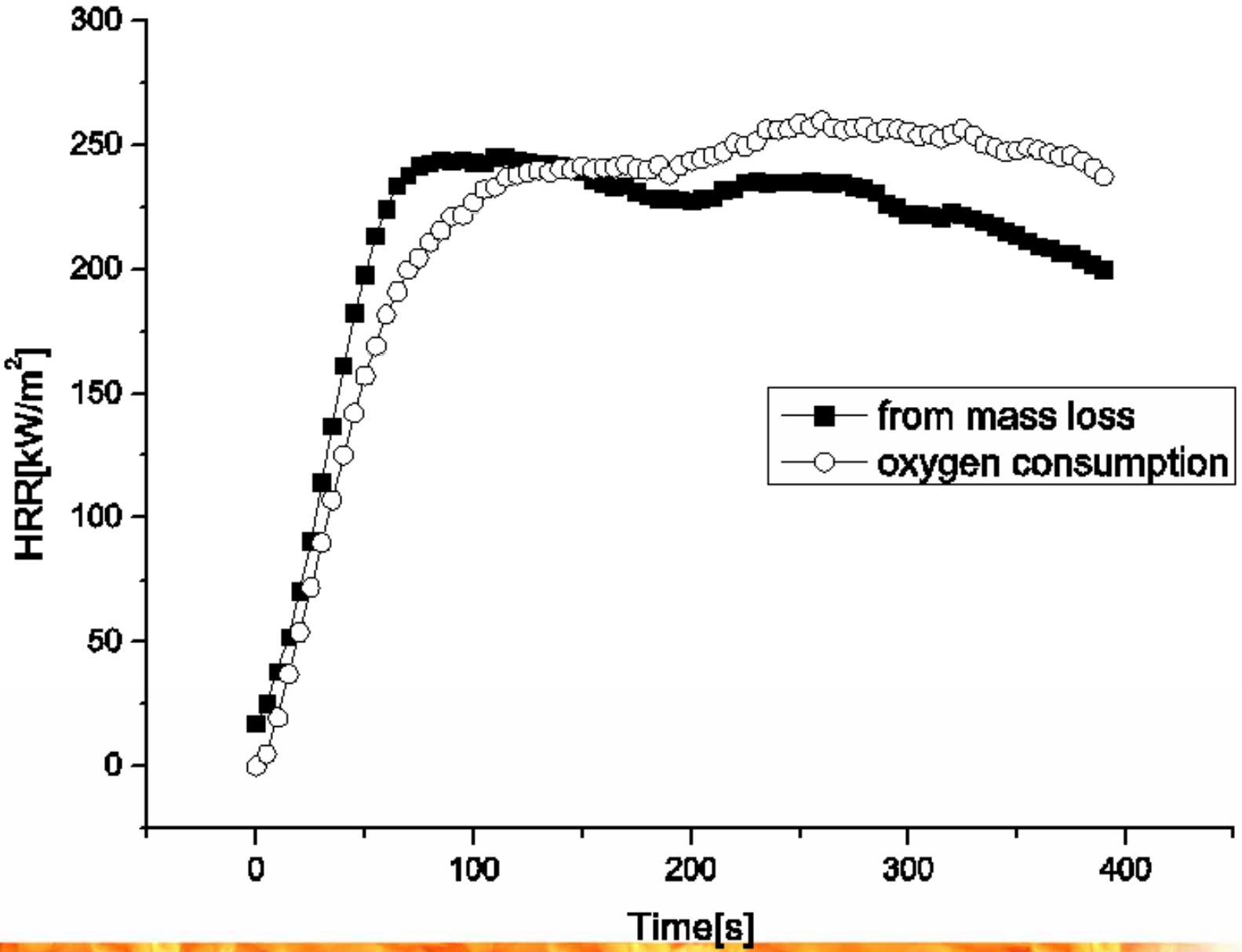
Tests for use as fire model input:

Plastic Samples (Keyboard) HRR curves



Tests for use as fire model input:

Plastic Samples (Keyboard) HRR curve comparison



Tests for use as fire model input:

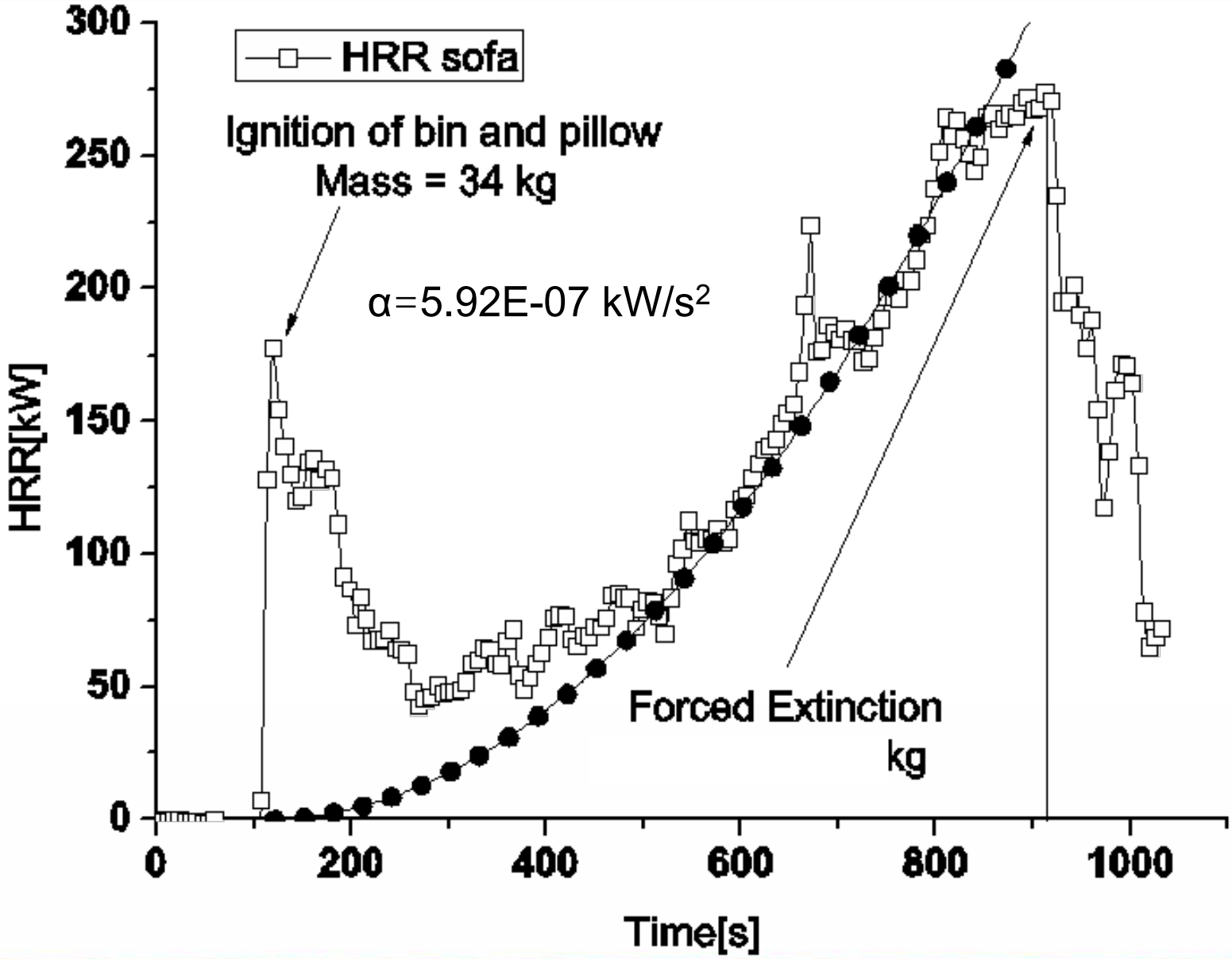
Sofa in Dalmarnock

Tests for use as fire model input:

Sofa

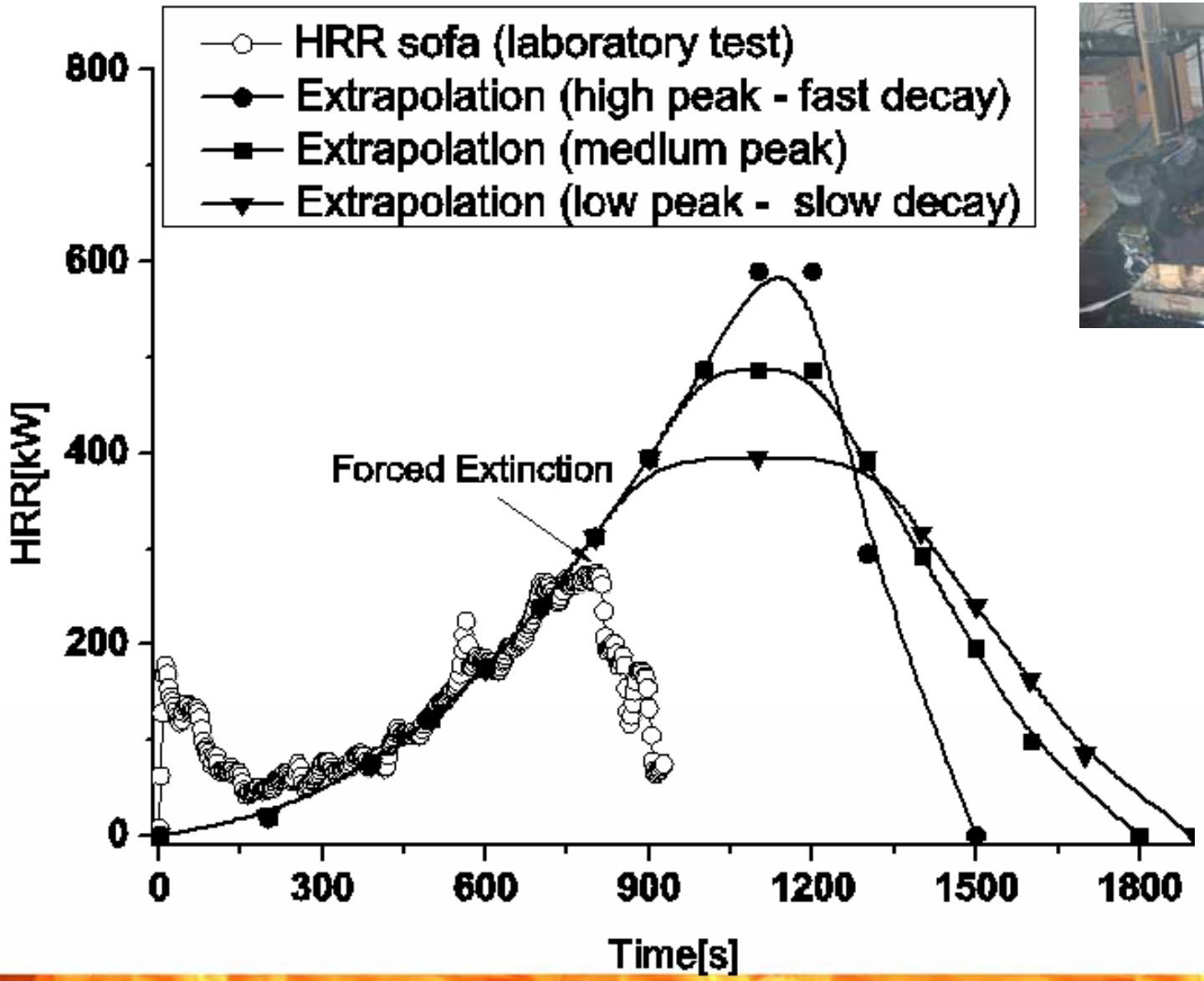
Tests for use as fire model input:

Sofa HRR curve



Tests for use as fire model input:

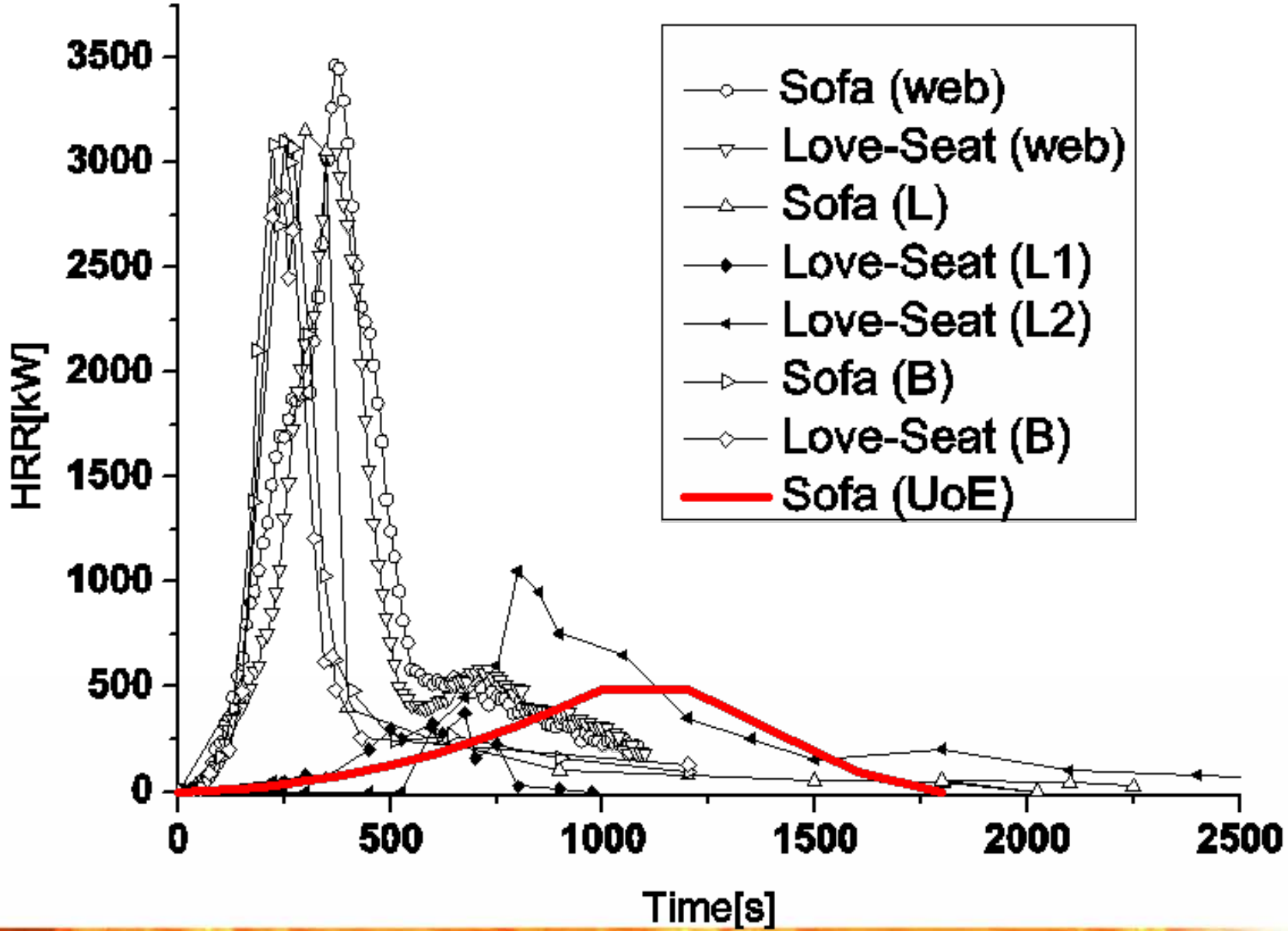
Sofa limited range of possibilities for the HRR curve



THE UNIVERSITY OF EDINBURGH

Tests for use as fire model input:

Sofa HRR curve comparison



Tests for use as fire model input:

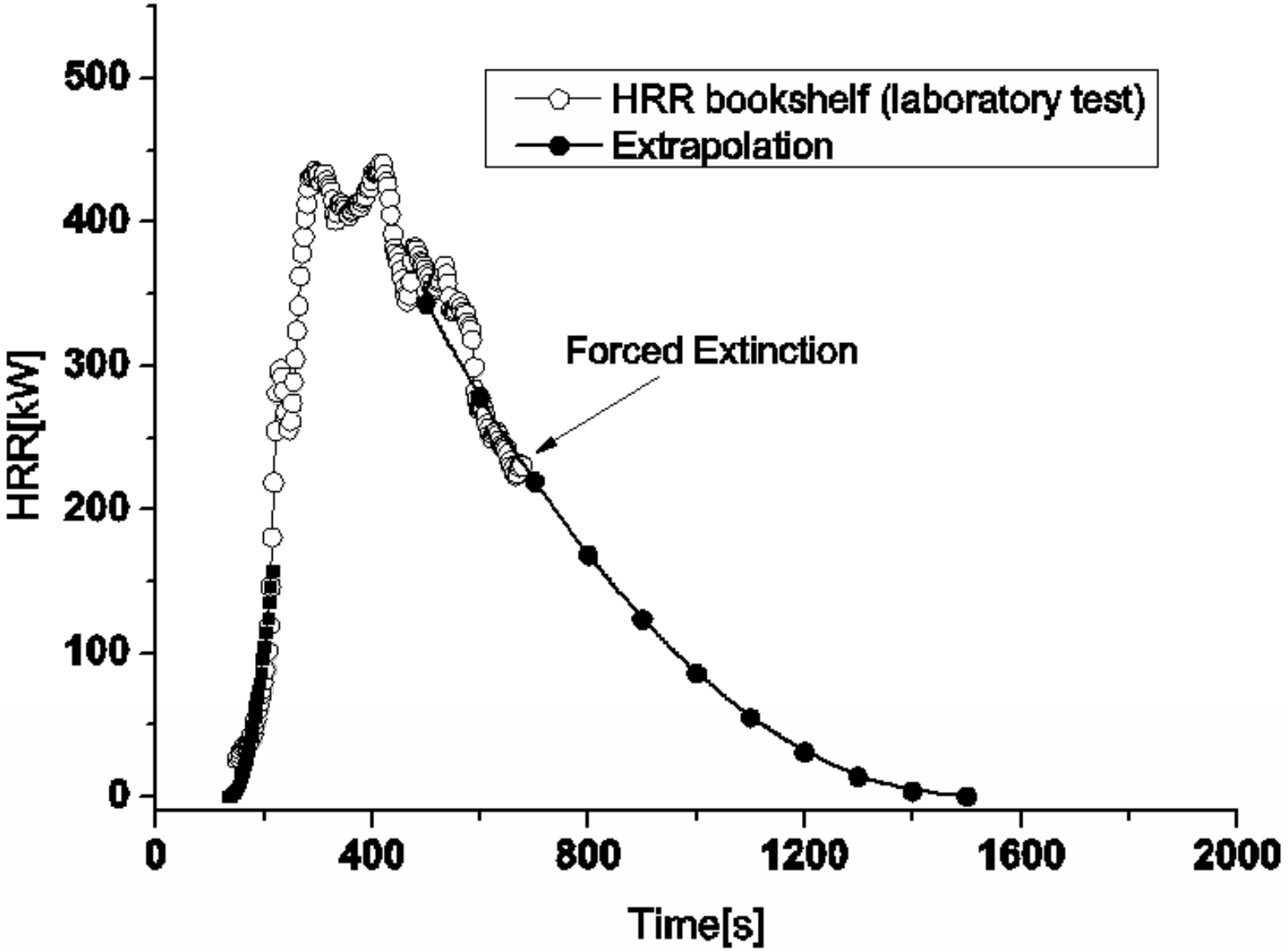
Bookshelf in Dalmarnock

Tests for use as fire model input:

Bookshelf HRR curve

Tests for use as fire model input:

Bookshelf HRR curve



Summary

- ***HRR per unit area*** *(small samples)*
- ***HRR*** *(lager items)*
- ***Critical heat fluxes***

Thank you!