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GRASS

AUTEX 2019
19TH WORLD TEXTILE CONFERENCE
TEXTILES AT THE CROSSROADS

Contribution of infill materials to the fire behavior of artificial grass

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Context

Increasing use of artificial grass for various applications:

SPORT FIELDS

LANDSCAPING: outdoor recreational and private

INDOOR: playgrounds, parks, event halls…

Advantages:

- cost savings: lower maintenance, in all weather conditions, durability
- environmental benefits: less water, no need for pesticides

Artificial grass mainly composed of organic materials

FIRE RISK

Westfields sport synthetic grass fire, March 2011

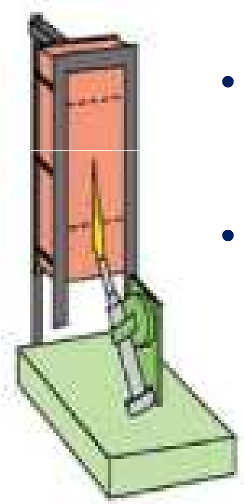
Fire in a playground, Alaska, April 2017

But how to evaluate the burning behavior of artificial grass?

EN 13501-1 classification

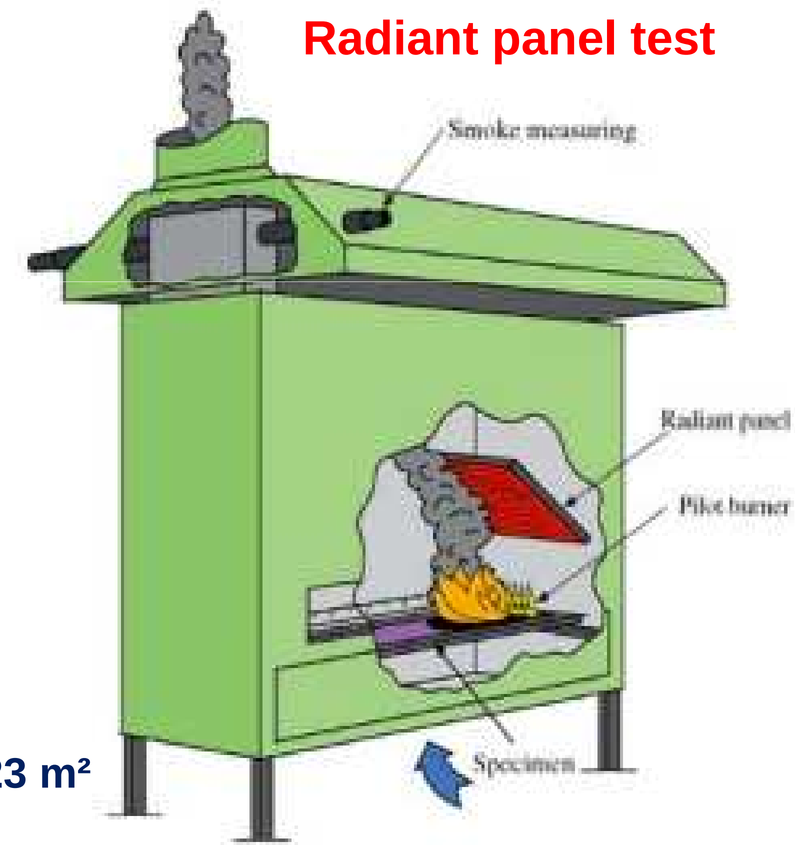
Determination of the burning behavior of flooring products

EN ISO 11925-2
Single-flame source test



- Specimen size: 250 × 90 mm²
- Determination of the flame height

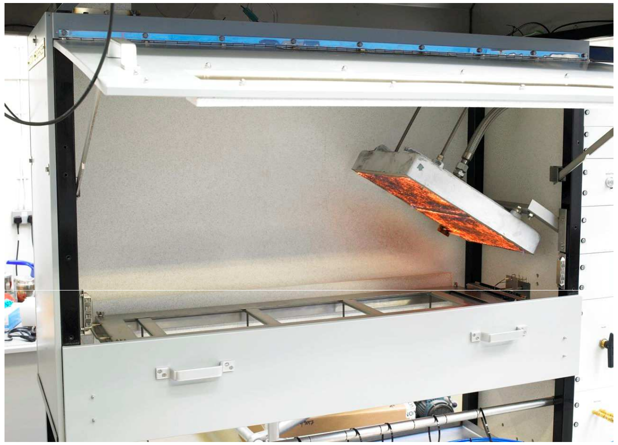
EN ISO 9239-1
Radiant panel test

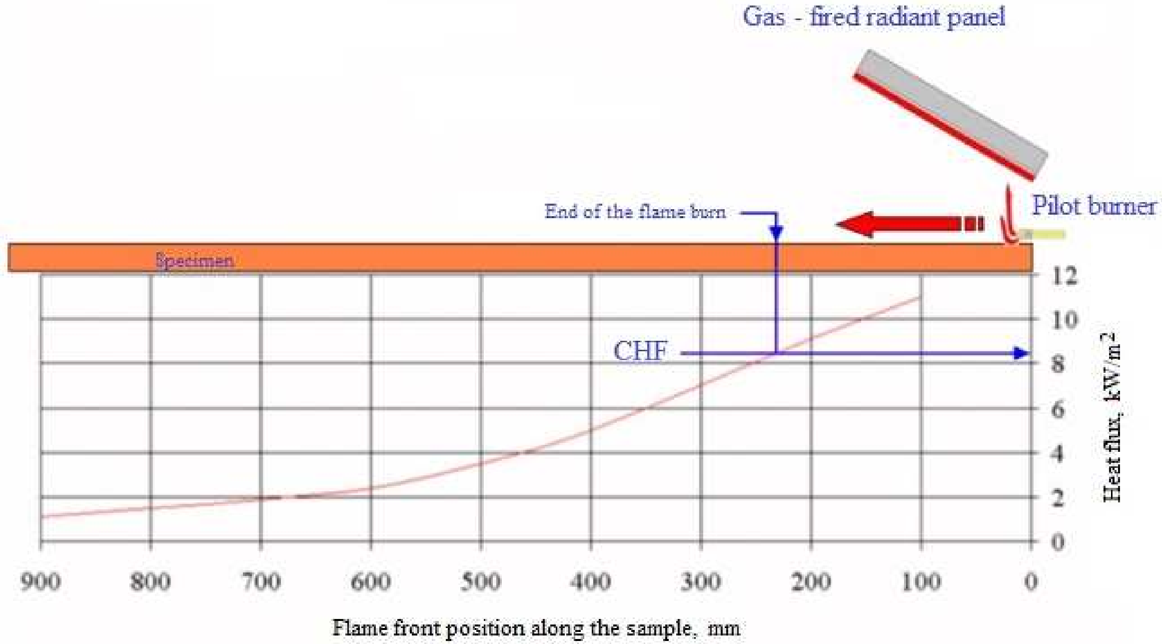


- Specimen size: 1.05 × 0.23 m²
- Max test duration: 30 min
- Flame spread distance
- Smoke production

ISO 9239-1: radiant panel test

Required heat flux distribution





Determination of the critical heat flux (CHF):

- **point where the flame ceases to advance (specimen extinguishment)**
- **position of the front flame after 30 min of test (no self-extinguishment)**

Classification of fire performance

Classes of reaction to fire performance for floorings – EN 13501-1

Class	Test method	Classification criteria	Additional requirements
B_{FL}	Radiant panel test Single-flame source test*	CHF ≥ 8 kW/m² Fs ≤ 150 mm within 20s	Smoke ≤ 750%.min (s1)
C_{FL}	Radiant panel test Single-flame source test*	CHF ≥ 4.5 kW/m² Fs ≤ 150 mm within 20s	Smoke ≤ 750%.min (s1)
D_{FL}	Radiant panel test Single-flame source test*	CHF ≥ 3 kW/m² Fs ≤ 150 mm within 20s	Smoke ≤ 750%.min (s1)
E_{FL}	Single-flame source test*	Fs ≤ 150 mm within 20s	
F_{FL}	No performance determined		

* EN ISO 11925-2, exposure 15s

Fire performance specifications

Indoor applications

Outdoor applications

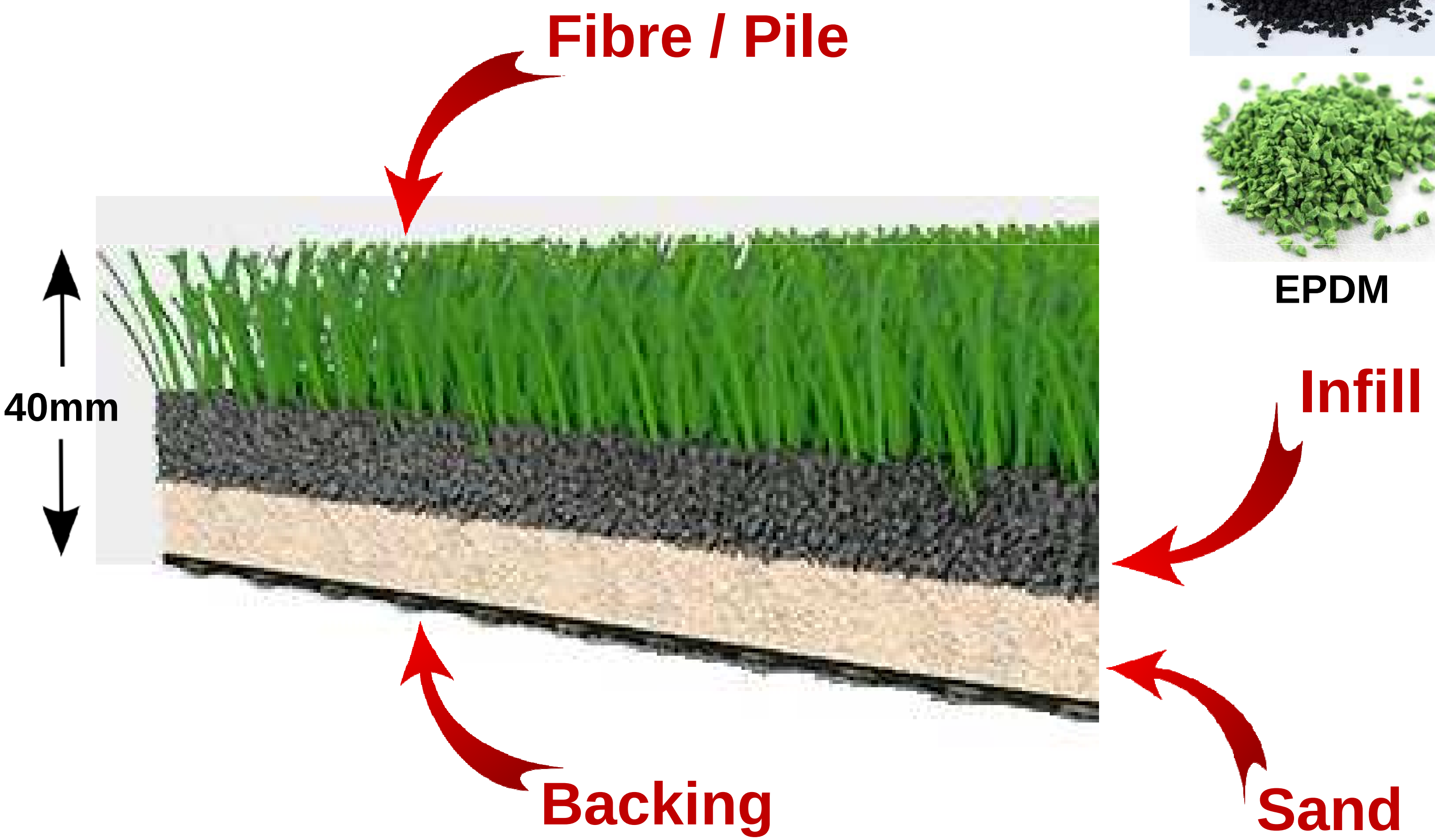
	Indoor / lanscaping	Sport fields
Current solution	Incorporation of sand	Use of fire retarded rubber
Reality	Almost always used without sand	Mainly rubber from recycled tyres

Objectives:

- Develop new fire retardant solutions
- Take into account the durability and ecological aspect
- Take into account the industrial feasibility

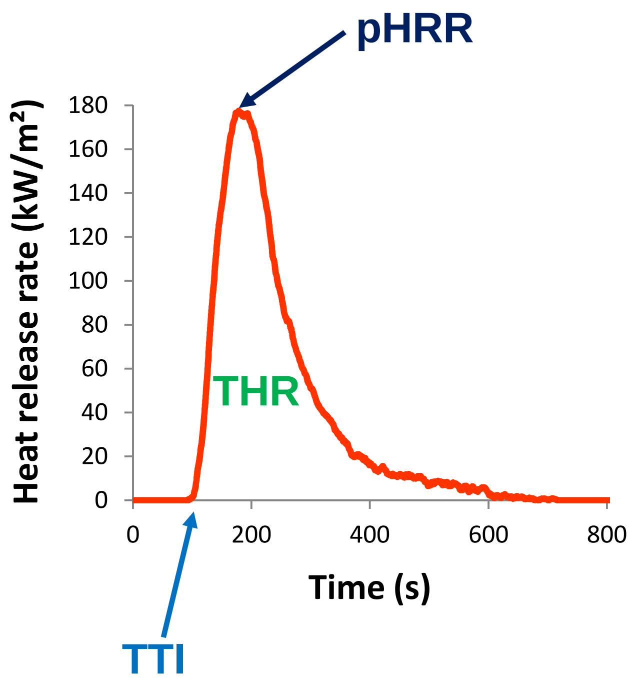
Artificial turf structure

Complex and multilayered material



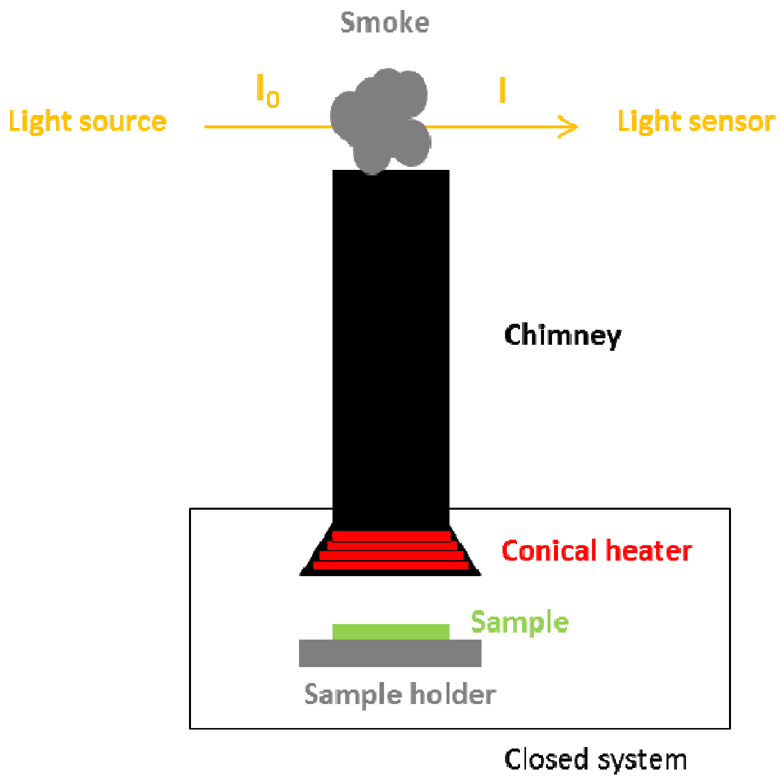
Mass Loss Calorimeter (MLC)

Sample 10x10cm²
25kW/m², 35mm
Forced ignition



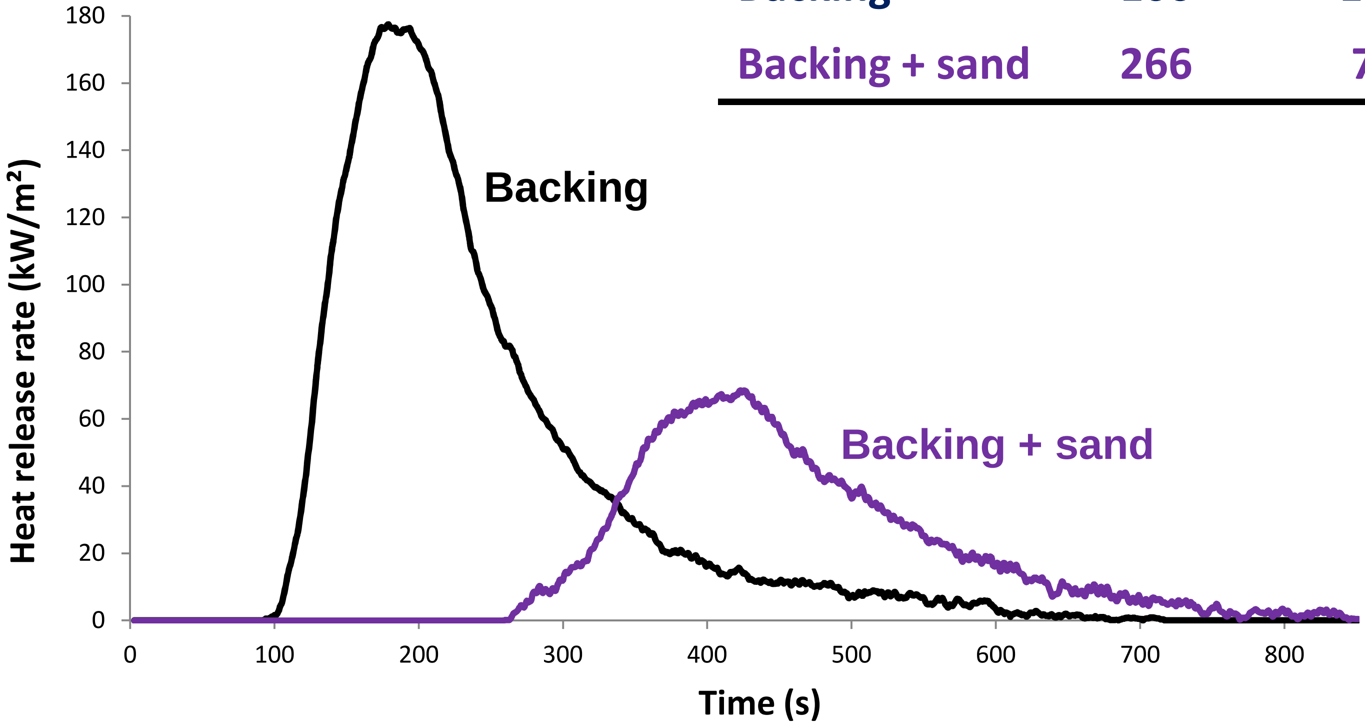
Mass Loss Calorimeter (MLC) coupled with smoke density analyzer

Sample 10x10cm²
25kW/m², 35mm
Forced ignition



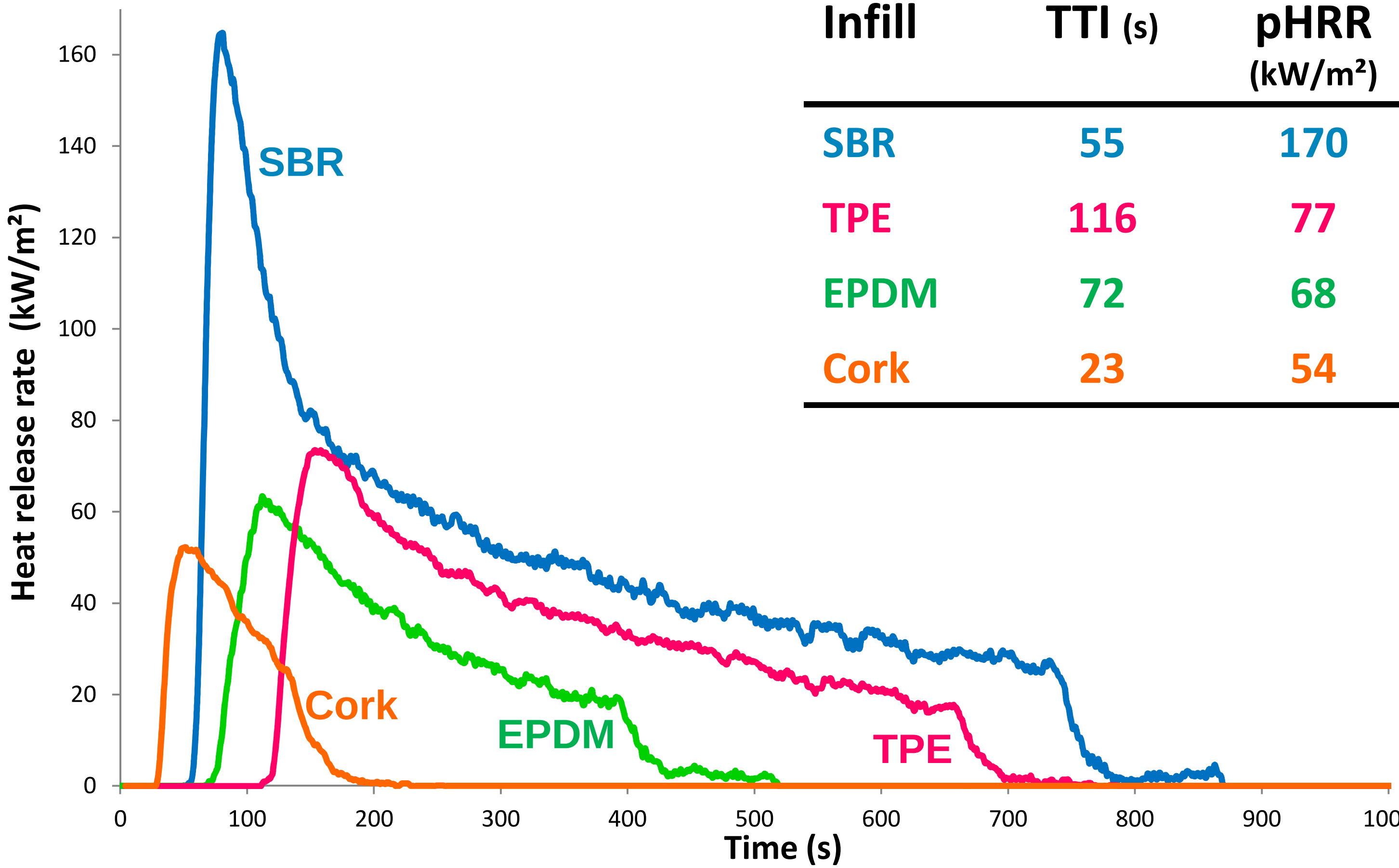
Fire behavior of backing

Infill	TTI (s)	pHRR (kW/m²)	THR (MJ/m²)
Backing	100	180	27
Backing + sand	266	72	14



Fire retardant effect of silica sand

Infill materials fire behavior



Infill	TTI (s)	pHRR (kW/m²)	THR (MJ/m²)
SBR	55	170	37
TPE	116	77	20
EPDM	72	68	12
Cork	23	54	5

Worst behavior obtained with SBR (in terms of pHRR and THR)

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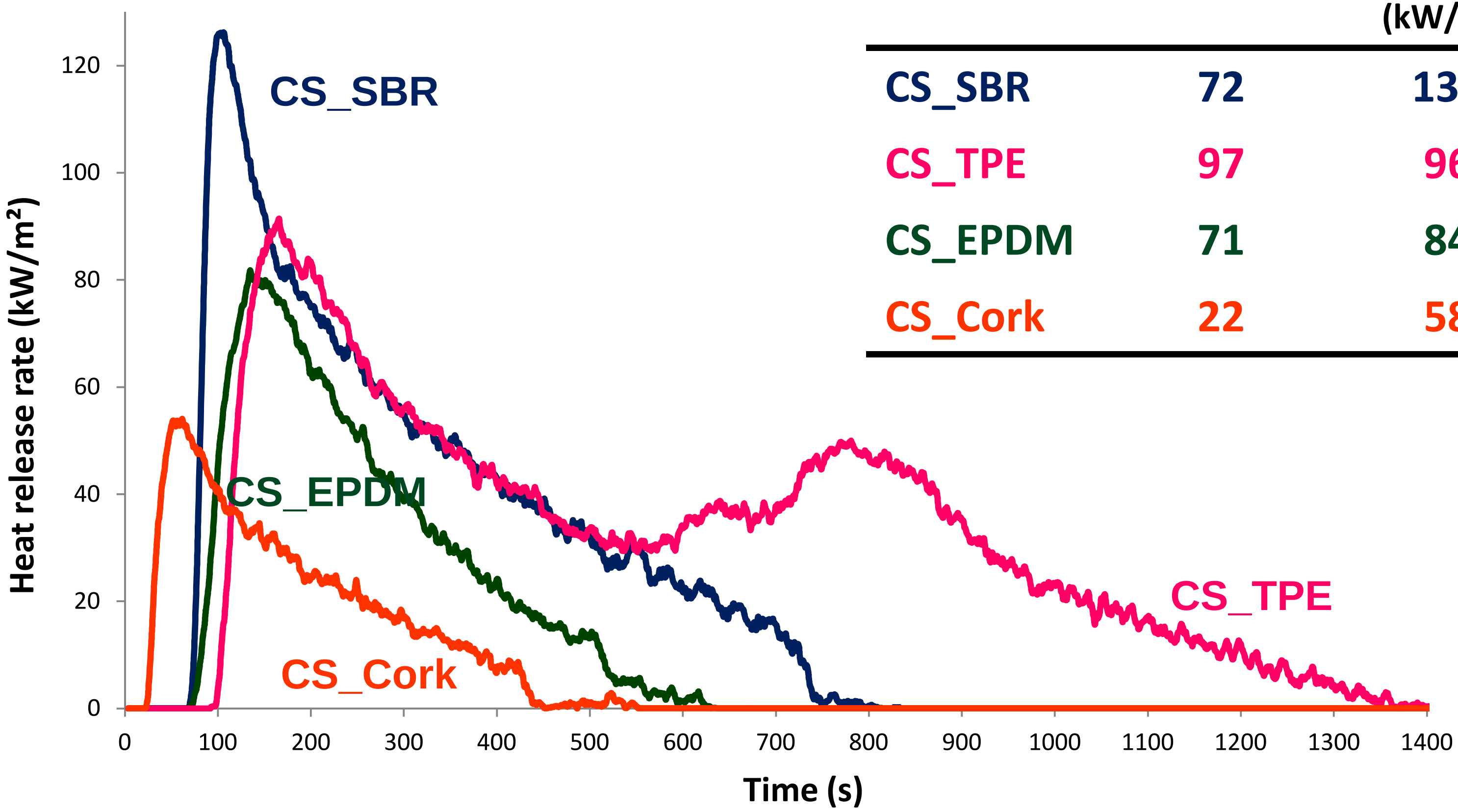
Fire behavior of the whole structures

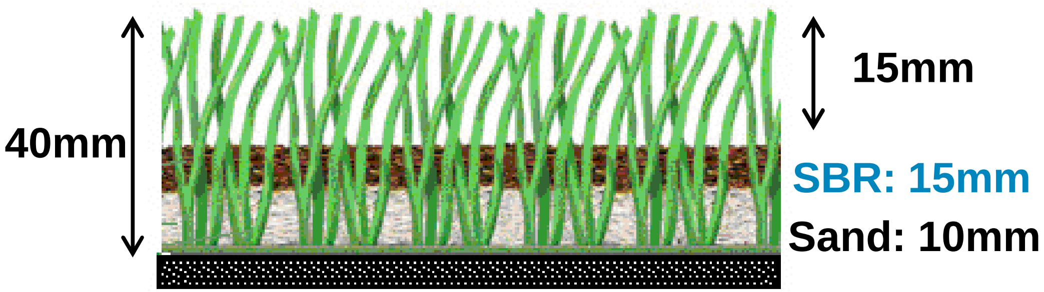
Structure	TTI (s)	pHRR (kW/m²)	THR (MJ/m²)
CS_SBR	72	131	32
CS_TPE	97	96	45
CS_EPDM	71	84	18
CS_Cork	22	58	10

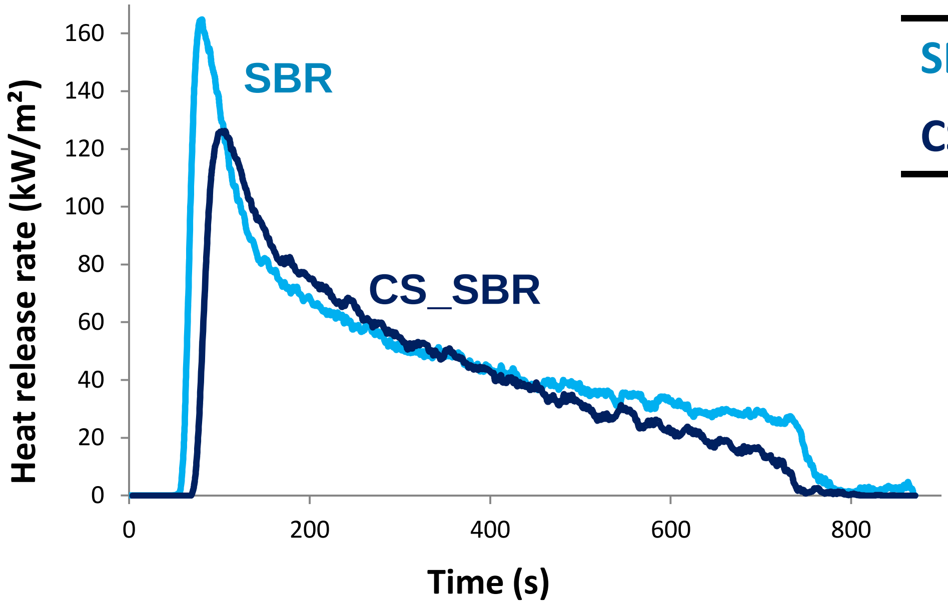


Worst behavior obtained with SBR in terms of pHRR

with TPE in terms of THR

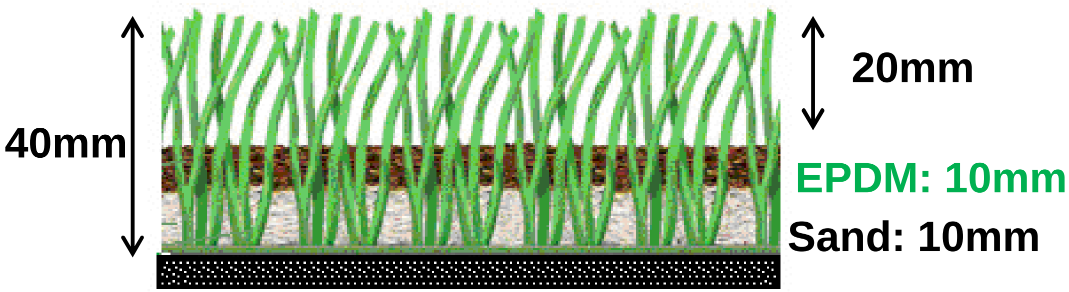
SBR structure fire behavior

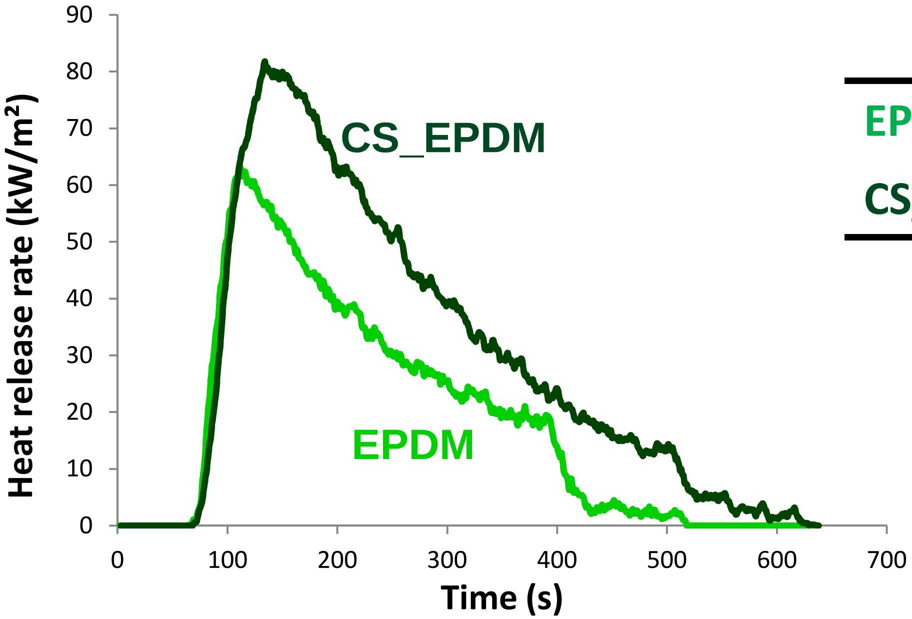




	TTI (s)	pHRR (kW/m²)	THR (MJ/m²)
SBR	55	170	37
CS_SBR	72	131	32

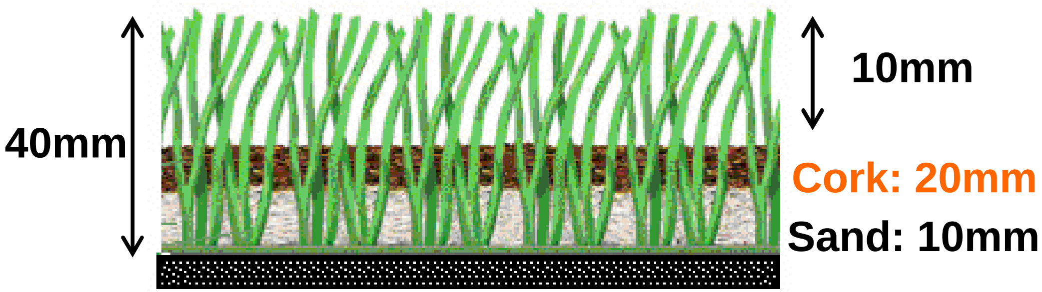
EPDM structure fire behavior

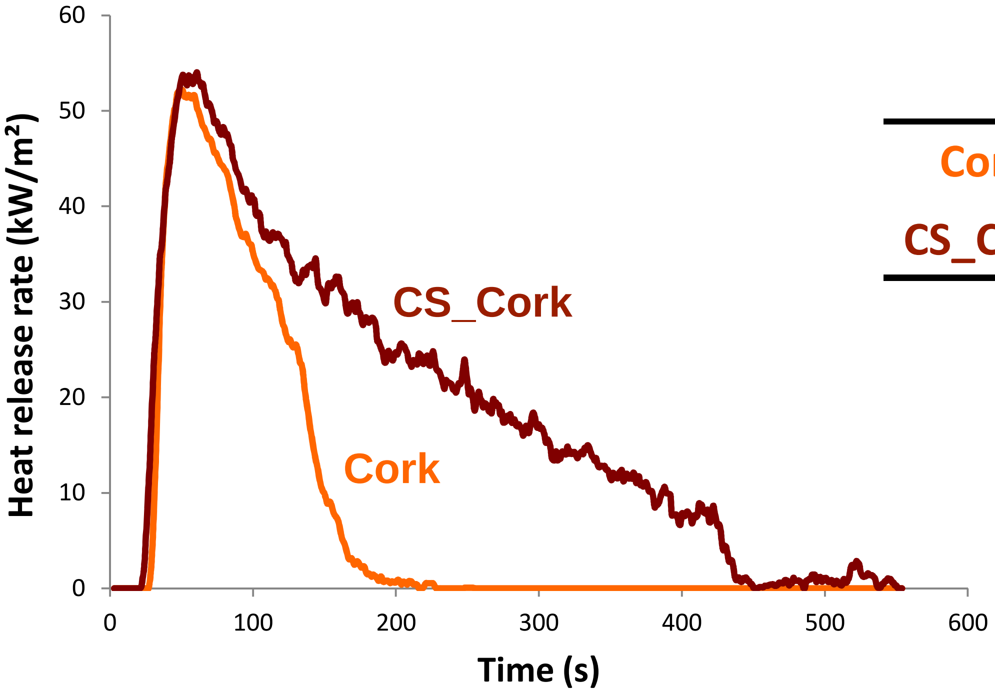




	TTI (s)	pHRR (kW/m²)	THR (MJ/m²)
EPDM	72	68	12
CS_EPDM	71	84	18

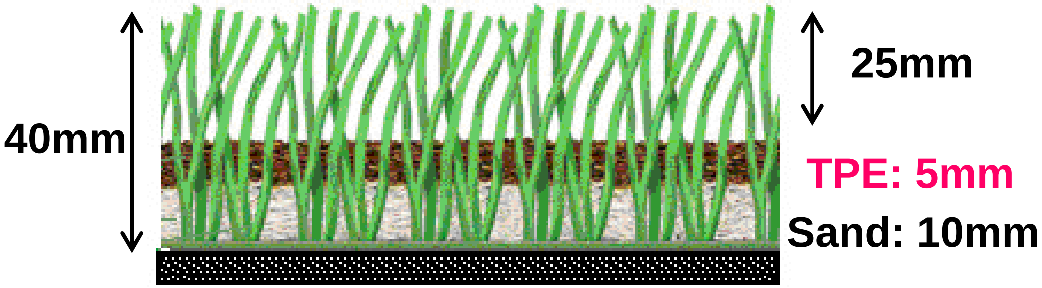
Cork structure fire behavior



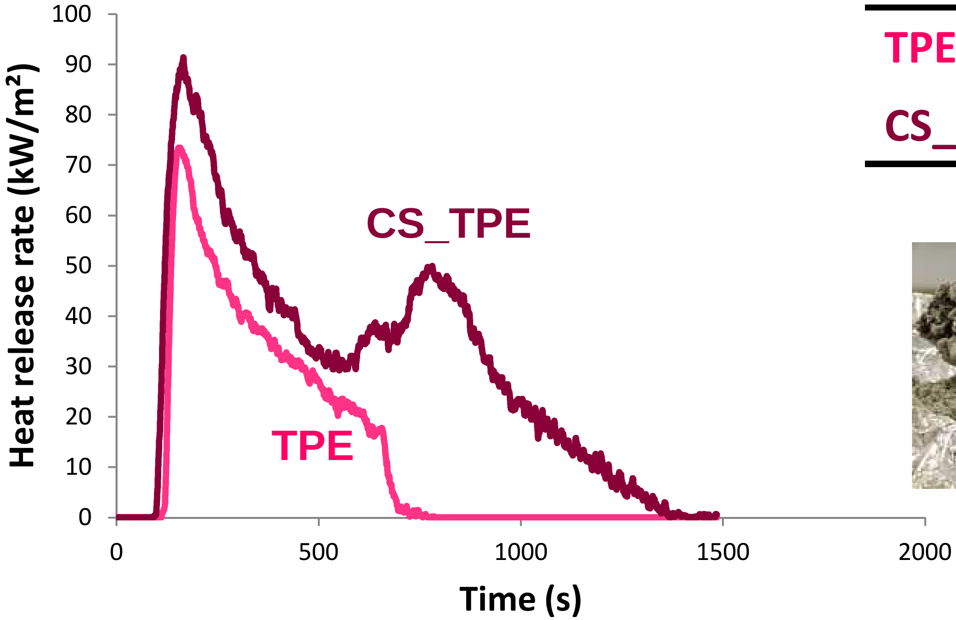


	TTI (s)	pHRR (kW/m²)	THR (MJ/m²)
Cork	23	54	5
CS_Cork	22	58	10

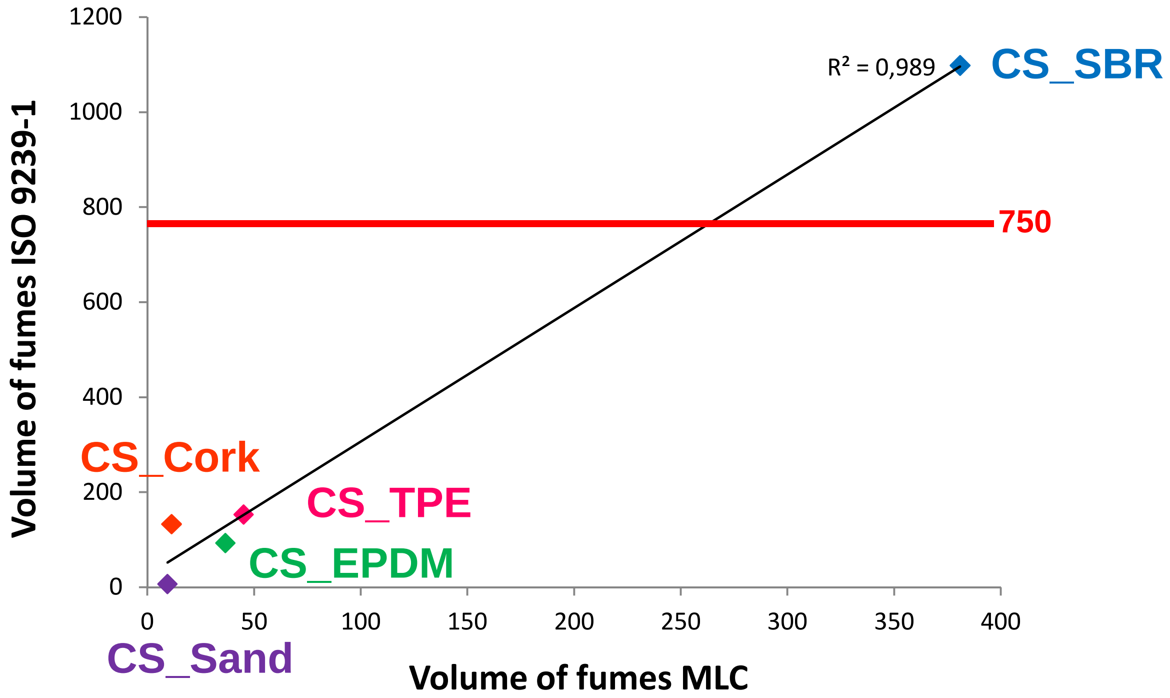
TPE structure fire behavior



	TTI (s)	pHRR (kW/m²)	THR (MJ/m²)
TPE	116	77	20
CS_TPE	97	96	45



Comparison of ISO 9239 and MLC tests



- Correlation of MLC and ISO tests
- High volume of fumes for the SBR structure

Conclusions

- **Curves of infill material and the corresponding grass structures superimposed until the pHRR**

  → **Crucial role of the infill material**

- **Correlation between radiant panel test and the MLC test in terms of volumes of fumes**

→ **Development of new formulations reaching Class C_{FL}-s1**

THANK YOU FOR YOUR ATTENTION

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