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Impact of lightweight materials on fire safety

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RISE Fire and Safety

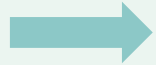
Outline

- Introduction – lightweight materials
- Fire performance – previous achievements
- Ongoing research projects
- Current state – Sweden
- Research project BMOB
- Closure/Discussion

Lightweight materials

- Reduce weight
- Strength and resistance

- Fire behaviour
- Thermal resistance



Safety of lives and construction must be considered in case of fire

Lightweight materials in generic groups

- Composite materials
  - FRP laminates
  - FRP sandwich products
  - Core materials
  - Coatings on non-combustible board
  - Intumescent mats
- Wood
- Aluminium

Areas for use of lightweight materials

- Aircraft
- Ship and marine applications
- Railway vehicles
- Automotive, busses, trucks
- Construction products

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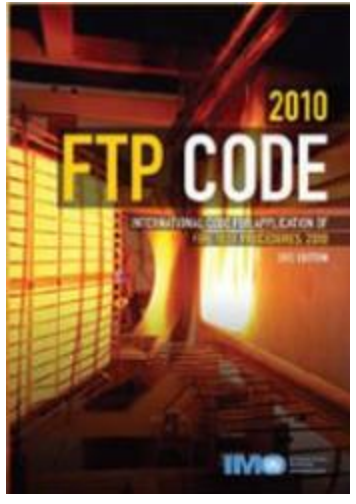
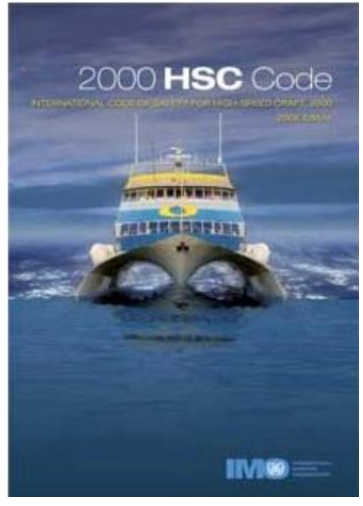
Fire requirements for marine applications

Fire requirements and testing according to:

- SOLAS
- HSC
- FTP Code





Materials can be divided into groups, related to performance criteria

- FRD – Fire Resistant Division Material
- FRM – Fire Restricting Material
- Interior surface material

Fire test method related to type of material/construction and end use application

Research project – fire and lightweight materials

SURSHIP-FIRE

FIRESAFE I and II

KOMPIS

SAFEDOR

FIRE-RESIST

COMPASS

KOFS

CONVINCE

BESST
Breakthrough in European Ship and Shipbuilding Technologies

Cost-FRM

LightSURF

AND MORE…

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SAFEDOR

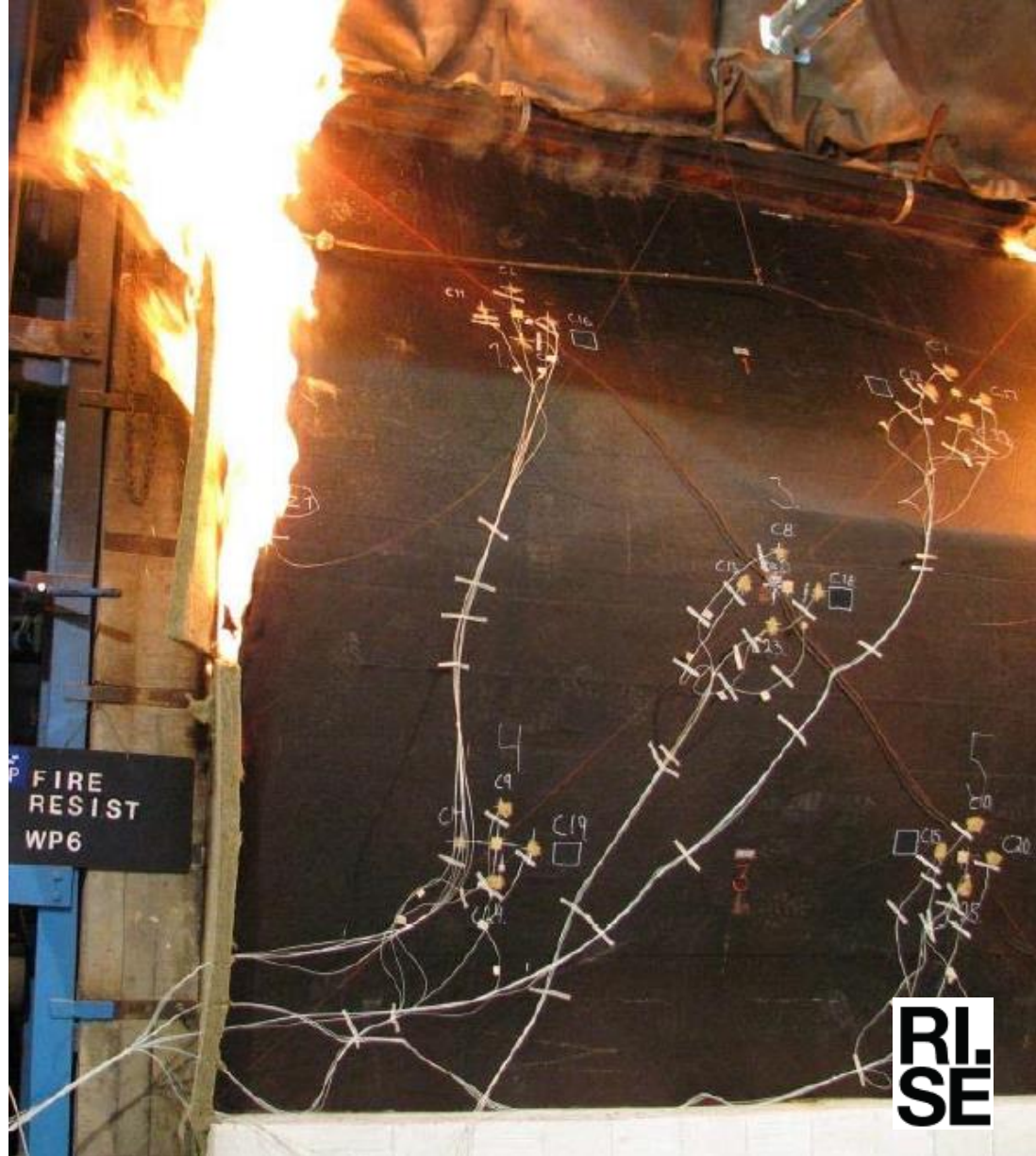
- 2005-2009
- Large scale project, developed a risk-based regulatory framework for the maritime industry and corresponding design tools.
- Material fire testing:
  - Small scale Cone Calorimeter
  - Flame Spread, Part 5
  - Large Scale FRD, Part 11

BESST

- 2009 – 2013
- Develop lightweight structural solutions for ship design which fulfil safety requirements, using combustible FRP composite structures
- Material fire testing:
  - Large scale facade test
    Two test series were carried out with focus on reaction to fire performance of external combustible FRP surfaces.
  - Large scale FRD testing, Part 11.
    Five test series consisted to evaluate the structural fire integrity of different FRP composite structures.

FIRE-RESIST

- 2011 – 2015
- Improving the fire performance of high-performance polymer matrix composite materials, sandwich consisting of three cork cores and four furan/glass fibre laminates.
- Material fire testing:
  - Flame spread, Part 5
  - Smoke and toxicity, Part 2
  - Small scale Furnace tests (FRD)
  - Large scale FRD, Part 11

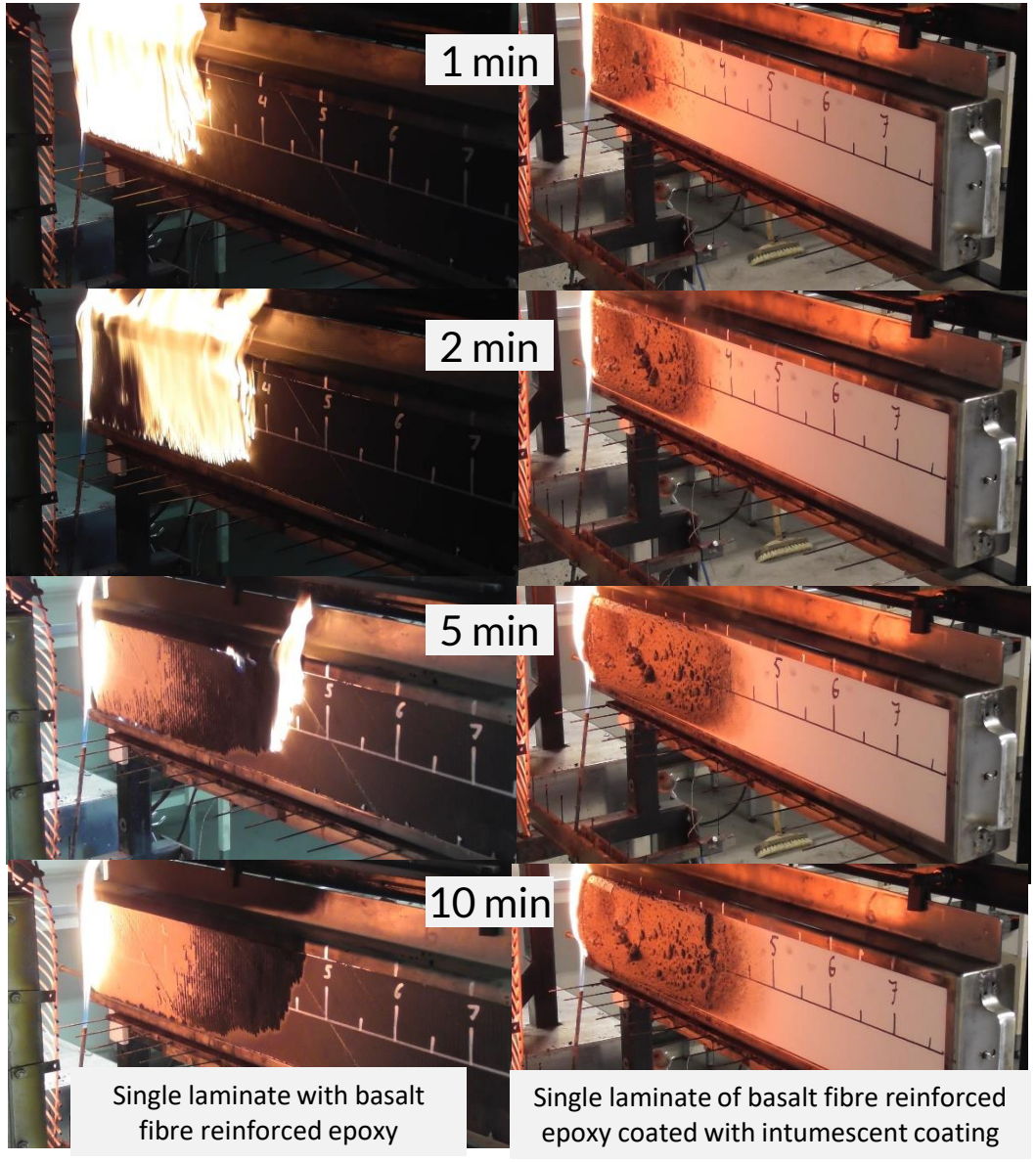


RAMSSES

- 2017 – 2021
- Full scale demonstrators of innovative components, maritime equipment and integration of composite materials in structure.
- ”Smart track to approval”, method for easier risk analysis and testing.
- Material fire testing:
  - Small scale Cone Calorimeter
  - Flame Spread, Part 5
  - Large Scale FRM, Part 10
  - Large Scale FRD, Part 11

LASHFIRE

- 2019 - 2023
- Aiming to significantly reduce the risk of fires on board ro-ro ships.
- A gap found in the fire regulations, no requirements for combustible interior surface materials for usage in ro-ro spaces.
- 36 materials tested
- Fire testing:
  - Flame spread, Part 5
  - Smoke and toxicity, Part 2.



Recently started EU-projects

BIOSAFIRE

Building the Future of Safe and Sustainable Flame Retardants

The BIOSAFIRE project aims to develop and promote safe, sustainable flame-retardant materials using a science-based and socially responsible approach.

Demonstrators/Use cases:

- Railway: bogie box part
- Marine: superstructure for patrol boat
- Construction: Wood coating
- Home appliance: Plastic part in fridge

Webpage: www.biosafire.eu

MAJOR

Maintenance, Joining, and Repair innovation in multidomain defence

Three domains:

- Air: fuselage of a UAV
- Sea: Mast structure of a navy ship
- Land: Cabin of a logistic vehicle

Webpage: major-project.eu

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Current state – fire

Research and testing show that there are materials and constructions that fulfil the fire requirements for interior surface materials and as FRD constructions.

The FRM requirements, IMO FTP Code Part 10, the room corner, harder to fulfil.

Fire tests show that combustible materials passes the first 10 min with the 100 kW burner. When the burner increase to 300 kW, the fire increases rapidly in the room and the test fails du to a flash over.

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Current state - Sweden

Increase in interest of **smaller vessels**, operating within the **territorial waters** of Sweden, with **short distance to shore** and easy to evacuate.

Vessels constructed with lightweight material, using new energy carriers.

These ships must be approved by the Swedish Transport Agency (TSFS 2017:26).

Basically, fire requirements according to SOLAS and HSC.

Current state - Sweden

Comments from the industry:

- Fire requirements from HSC
  - FRM
  - FRD
  - Surface interior materials
- FRM requirement hard to fulfil.
- Are these requirements of large-scale fire tests relevant for the small ships?
- One point of view: distance to shore is short and it will be reached before the size of the design fire is reached in real-life.

Background – new research project

- What are **appropriate fire-safety acceptance criteria** to apply for smaller vessels operating in national waters and built with lightweight materials?

- There are obstacles to using lightweight materials, as the safety requirements needed to meet current regulations, have not been developed for this type of vessel but instead apply to large oceangoing ships.

- More purpose-built regulations could lower costs while improving safety for crew, passengers, and cargo on board.

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BMOB – Study of regulations

Fire Safety in the Innovative Mobility Sector – A Comparative Study

Funded by:

TRAFIKVERKET

STIFTELSEN SVERIGES SJÖMANSHUS

Partners:

TRANSPORT STYRELSEN

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CSTRIDER

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BMOB – Study of regulations

1. Conduct a literature review of the current state of research in Sweden, integrating relevant scientific knowledge and risk assessment within the field.

2. Perform a comparative analysis of relevant regulations, guidelines, and standards in Sweden, and compare these with those of at least one other country.

3. Develop proposals for requirement levels and assessment criteria for lightweight and smaller vessels within the framework of Swedish national maritime traffic regulations.

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BMOB – Project limitations

- Passenger ship with up to 12 passengers.
- Less than 24 m.
- Only operating in national water.
- Type of energy carrier not included.
- Only fire will be addressed.

Cstrider

Candela

We need your help!

- What is your experience with smaller ships in national water?
- Any good examples? Bad examples?
- What regulations are you using? SOLAS? HSC? Other national?

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Thank you!

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