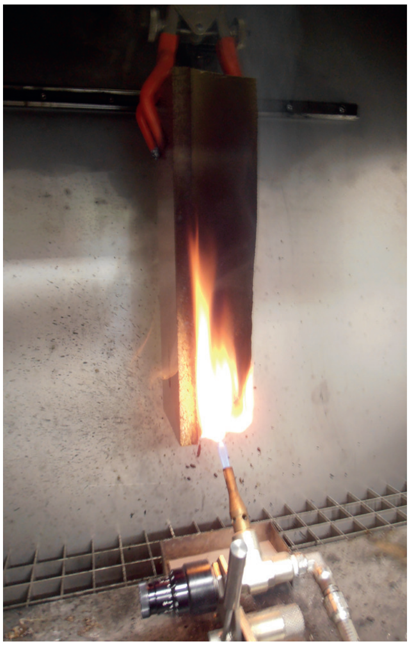
CREPIM: Material developer and test center

CREPIM

CREPIM (Centre de Recherche et d'Etude des Procédés d'Ignifugation des Matériaux/ Research Center for the Study of the Ignifugation process on Materials) is one of the leading European Laboratories for the development and the approval of materials covered by fire regulations. Located in the heart of Europe, CREPIM tests and develops fire resistant formulas for companies working in the mass transportation sector such as railway, electrical and textile applications, in buildings electrical systems.

Its activities feature six areas:

- Development of fire retardants and fire resistant material for concerned applications.
- Assessment of the fire properties of materials:
  - Flame propagation,
  - Smoke opacity,
  - Smoke toxicity,
  - Thermal insulation,
  - Integrity.
- Participation in French mirror groups and European Standardization Committees on plastics (TC 61), building (TC 92), and railways (TC 256).
- Recycling of fire-retarded plastics.
- Surface functionalization of material and assemblies.
- Training for companies featuring:
  - Developments and trends in European Fire Regulation regarding key sectors (mass transport, Electric & Electronic Equipment…),
  - European environmental regulation restricting the use of certain fire-retardant additives,



Allumability test

  - Latest strategies to fire-retard polymeric materials.

The test reports released by CREPIM are recognized worldwide:

- CREPIM has been accredited by the COFRAC since 1999 on 20 fire tests featuring National, European and international regulation,
- CREPIM has been recognized in 2003 for the testing and qualification for railway industries by the French certification body CERTIFER (SNCF/RATP),
- CREPIM has been recognized in 2007 by VERITAS for the testing and qualification for the International Maritime Organization (IMO),
- Since 2009, CREPIM has been a notified laboratory n°2137 System 3 for the initial testing type in the framework of the construction product directive and System 1 since 2012 for the audits in production plants in the framework of the CE labelling,
- Since 2010, CREPIM is recognised by the French Ministry for delivering of the official test reports "Procès-Verbal".

CREPIM also has recognition in the automotive industry and in some cross-industries such as the electronic and the electrical fields (FMVSS302, UL94…).

Focus on railway test

Recognized by CERTIFER (SNCF/ RATP) and accredited by the COFRAC, the CREPIM edits test reports in accordance with NF F 16-101, NF F 16-102 and the new European standard EN 45545-2. CREPIM supplies a direct access to the French and European railway market.

Tests according to EN 45545-2

1. ISO 5658-2, Lateral Flame Spread – Propagation test

Principle: Specimens are held in a vertical orientation and exposed to a gas fired radiant panel and a pilot flame. The hot end of the specimen receives a radiant heat flux of 50, 5 kW/m² and this gradually decreases to a level of 1.2 kW/ m² at the cool end.

Although the pilot flame does not impinge on the surface of the specimen it will act as an ignition source for any volatile gases produced by the product. During the course of the test the maximum flame travel along the specimen is recorded. The following parameter is then

Cone calorimeter

determined: Critical Heat Flux at Extinguishment (C.F.E.) – a measure of how far the flames have travelled across the surface of the specimen

2. ISO 5660-1, Cone calorimeter test

General: The Cone Calorimeter was developed in the USA by NIST and is used to determine the rate at which heat is evolved from a fire involving a material. The apparatus uses the principle of oxygen consumption calorimetry to determine the rate of heat release, maximum heat release and the total heat release to enable modeling techniques to be used to predict time to flashover thus assessing one parameter which contributes to the overall hazard of a material.

Principle: The apparatus is designed to measure the response in either a vertical or horizontal position and is based on the premise that for a range of materials, the net heat of combustion is proportional to the amount of oxygen required for combustion. A small sample of material is exposed to the irradiance generated by a truncated cone heater. Decomposition gases generated by the heater are ignited by a spark and the resultant combustion gases are drawn through an exhaust system containing various instrumentation.

Continuous measurement of oxygen, carbon monoxide and carbon dioxide together with the exhaust flow rate allow the determination of heat release with time. A range of exposure conditions is used, from 10 kW/m² to 100 kW/m². In both orientations, the specimen is mounted on a load cell to measure mass loss which can itself be used to determine heat release rate. Smoke development and temperatures can also be monitored in the exhaust duct.

The value which is required in the European standard is the MARHE which is directly linked to the heat rate release.

3. ISO 5659-2, Determination of Smoke Opacity

Principle: The aim of this test method of ISO 5659-2 ("Determination of Optical Density by a Single Chamber Test") is to expose a material to specified thermal conditions of pyrolysis and combustion in a continuous procedure. The change in optical density of the smoke produced when dispersed within a fixed volume of air is recorded throughout the period of test.

The resulting smoke density/time curve is used to calculate the specific optical density figures, which can be used to determine VOF4, Ds4min or Dsmax as required for the specific product function. The test is carried out in a chamber of 0.5m³ in volume. The specimen sits inside a small metal holder with one face left exposed (this ensures that it is a surface test only). The container is then placed inside the chamber below a cone heater in a horizontal position. The irradiance level of the cone heater is set to one of the following levels, depending on the specific product function:

- 25kW/m² in the absence of a pilot flame
- 25kW/m² in the presence of a pilot flame
- 50kW/m² in the absence of a pilot flame

VOF4 is calculated as follows:
VOF4 = Ds1min + Ds2min + Ds3min + (Ds4min/2)

Where Ds1min, Ds2min, Ds3min and Ds4min are the values of the specific optical density recorded at the 1st, 2nd, 3rd and 4th minutes respectively.

Dsmax is the maximum specific optical density obtained within the 20 minutes test period.

Cone calorimeter

4. Annex C: Gas analysis in the ISO 5659-2 Smoke Chamber, using FTIR analysis Technique

Principle: This particular test requirement can be conducted in conjunction with the smoke density analysis as described above.

The sampling of fumes is made during the testing of each of the three specimens tested above, at 4 and 8 minutes test duration. The analysis of each relevant gas is made by an IRTF apparatus. The concentration of each of the following toxic gases is recorded and compared to relevant reference values in order to determine the CIT value (the magnitude of the reference values is based on the danger posed from the gas in question):

- Carbon monoxide (CO)
- Carbon Dioxide (CO_2)
- Hydrogen Bromide (HBr)
- Hydrogen Chloride (HCl)
- Hydrogen Cyanide (HCN)
- Hydrogen Fluoride (HF)
- Sulphur Dioxide (SO_2)
- Nitrous Oxyde (NOx)

5. NFX 70-100, Toxic gas emission

General: NF X 70-100 is a mass based toxic gas analysis test method. The test standard allows the measurement of many different toxic gases. For the purpose of F rating classification in accordance with NF F 16-101, the gases which are analyzed are as follows:

- Carbon monoxide (CO)
- Carbon Dioxide (CO_2)
- Hydrogen Bromide (HBr)
- Hydrogen Chloride (HCl)
- Hydrogen Cyanide (HCN)
- Hydrogen Fluoride (HF)
- Sulphur Dioxide (SO_2)
- Nitrous Oxyde (NOx)

Principle: The test is conducted within a tube furnace where the temperature is generally 600°C. For wire application, the temperature is 800°C. Toxic fume emission testing is then carried out in triplicate and the average of these results is used to calculate the "CIT" Value. The collection/measurement of toxic fumes takes place throughout the 20 minutes test duration. The toxic fume emission is expressed in milligrams per gram of material, on the assumption that the mass of the test piece is 1g.

6. ISO 4589-2, Limit of Oxygen Index determination

General: Methods are provided for testing materials that are self-supporting in the form of vertical bars or sheet up to 10.5mm thick. A method is provided for testing flexible sheet of film materials while supported vertically. The results obtained are dependent upon the shape, orientation and isolation of the test specimen and the conditions of ignition.

ISO 4589 – Part 2 – Oxygen Index – Ambient Temperature Test

This Part of ISO 4589 specifies methods for determining the minimum concentration of oxygen, in admixture with nitrogen that will support combustion of small vertical test specimens under specified test conditions. The test is performed at an ambient temperature of 23°C ± 2°C. The results are defined as oxygen index values define as LOI.

Principle: A small test specimen is supported vertically in a mixture of oxygen and nitrogen flowing upwards through a transparent chimney. The upper end of the specimen is ignited and the subsequent burning behavior of the specimen is observed to compare the period for which the burning continues, or the length of the specimen burnt, with specified limits for such burning. By testing a series of specimens in different oxygen concentrations, the minimum oxygen concentration is determined.

7. Other tests concerned by the EN 45545-2

- NF EN ISO 11925-2, Small flame test. The product allumability is assessed thanks to a little flame applied on the vertical sample.
- NF EN ISO 9239-1, Radiant Panel Floor – Flame propagation. The radiant panel floor test is the reaction to fire test dedicated to the floor coverings. The aim is to assess the fire behavior, the flame propagation and the smoke development when exposed to a gradient energetic flow. ■

Contact Information

Stéphane Boissel
Head of Fire Testing Activity
stephane.boissel@crepim.fr
www.crepim.fr