CHOICES OF FLAME RETARDANT MATERIALS FOR CABLES WITH IMPROVED BEHAVIOUR IN FIRE

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ABSTRACT

This paper describes three different applications of halogen free flame retardant (HFFR) compounds, covering high voltage, optical fibers and low voltage cables. In each example, the cable design is described and the results obtained in term of physical properties as well as reaction to fire are presented. This article focuses on the importance of the material formulation with respect to the particular design and specifications of the cable. It is shown that HFFR materials can combine good mechanical, thermal and fire (flame propagation and smoke density and toxicity) behaviour.

KEYWORDS

HFFR compound, high voltage, optical fibres, OGP, fire behaviour

INTRODUCTION

More or less recent events (tunnel of the Mont Blanc, Austria funicular, National library in Paris) showed the catastrophic effects of the fires, for the people and the goods.
During these disasters, we could measure the importance of the side effects related to the fires:

- o the opacity of the smoke, which makes very difficult the localisation of the fire,
- o the toxicity of combustion gases, at the origin of approximately 60 % of the human losses.

Although they are not directly at the origin of disasters, the cables, because of their linear feature, can contribute to their propagation.
However, the large users such as the Railways, oil and gas industry, power utilities, understood for a long time the interest to reduce the side effects of fires.
In cable-making industry, the reduction of these side effects means the replacement of chlorinated polymers, by specific halogen free flame retardant materials. The current trend is to generalize the use of these compounds for sensible applications, and in particular for installations in closed environments. This is supported by the European CPD (Construction Products Directive), which concerns all the materials that could be found in a building.
A classification of cables according to their heat release during a fire has recently been introduced in this Directive.
We present today some developments of fire retardant cables, in 3 different fields:

- High Voltage,
- Optical Fibres,
- Oil, Gas and Petrochemicals applications.

A-PRESENTATION OF THE TESTING METHODS

From their behaviour in fire, the electric cables are looked under several aspects:

1. Propagation of fire

Two International standards are used to evaluate the behaviour of the cables in the event of fire:

o Propagation of flame (EN 50265-2-1)
A sample of 600 mm long is subjected to the flame of a 1 kW gas-burner during 1 to 5 minutes. After the test we check the undestroyed length, which must be higher than 50 mm.

o Propagation of the fire (IEC 60332-3)
The test consists to subject a layer of 3.5 m height to a 20 or 40 kW gas-burner, during 20 or 40 minutes. The destroyed height must be lower than 2.5 meters.

2. Smoke opacity (IEC 61034)

The smoke opacity is one of the important side effects to take into account.
It is possible to measure the opacity of the smoke released by lengths of cable, which are placed in a cubic tight room of 3 meters edge above an heating source constituted by a flamed alcoholic solution. Smoke develops in the room, which is provided with a source of light on one side, and with a photometric cell of reception on the other side.
We measure finally the loss of luminous transmission, in term of optical density (D = log 100/T) at a distance of 3 meters.

3. Halogen content (IEC 60754-1)

The test is used to evaluate the amount of halogen acid gas (except hydrofluoric acid) produced during the combustion of a material sample. It allows to know the corrosive feature of combustion gas, which could cause damages on equipment surrounding the burning cable. The sample is heated in a tube furnace in a stream of dry air, and the gas is bubbled in 0.1M sodium hydroxide solution. The quantity of halogen acid is measured by colorimetric titration and should not exceed 5 mg/g.