Development of an Alternative Solution to Mica Tape for Fire Resistant Cables

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ABSTRACT

Until recently fire resistant cables used Mica tapes as the fire resistant insulation material. The problem with this design was that Mica tapes were very brittle and may break during normal handling of these cables. Therefore to improve the mechanical properties a small polymeric layer was extruded over these tapes.

Recent developments have taken place that include a combination of these two layers into the one tape and the removal of the extrusion process covering the Mica tapes. This paper will demonstrate, with examples, the advantages of these tapes as compared to the conventional construction using Mica tapes. Currently these tapes are mainly used for low voltage cable applications, but tests are on going to use these tapes for medium and even lower high voltage cable applications where fire performance is required.

There are also compounds available based on these materials, which could be extruded as a filling compound.

Test are ongoing using these tapes for higher voltage cable, even currently is no real demand for that application. However these cables could replace Mica cables and also PVC sheathed cables, since the are more economically friendly than the latter and create less hazardous gases in case of fire, which might destroy sensitive equipment in the area.

KEYWORDS

Fire Resistant Cables, Mica Tape Alternative

INTRODUCTION

Various methods are used to make safety cables fire resistant. One proven method is to apply a Mica tape insulation layer directly on the metal wire. The layer protects against short circuit in case of fire and helps to significantly extend the system integrity for emergency power supply, fire alarm and evacuation systems in buildings, tunnels and rolling stock materials or in other safety related applications.

There have been early developments using Mica-loaded paper for EHV power cable [1]. Nowadays with the development of ceramifying polymers, these polymers can be produced either as compound or as tape.

In the past the most widespread technologies to guarantee the electric cables connection integrity during a fire were the following:

- ceramified silicone-rubber
- Mica-glass tape and cross-linked polyolefine

The taping with Mica tape is the most typical solution; it allows the use of several insulation materials since the fire resistance is guaranteed by the tape. The silicone rubber is currently the most frequently used solution and simplifies and speeds up the installation, thanks to the easy peeling and to the lack of tape.

The materials that we are presenting in this paper are based on silicon.

Silicon is one of the most widely used elements. A considerable amount of research has shown that the addition of relatively small amounts of silicon compounds to various polymeric materials can significantly improve their flame retardancy. Silicon-containing flame retardants are considered to be environmentally friendly additives because their use leas to a reduction in the harmful impact on the environment when compared with existing materials. Many forms of silicon compounds have been explored as potential flame retardants to polymeric materials.

Silicone materials exhibit relatively low rates of heat release, a uniquely low dependence of rate of heat release on external heat flux. One of the causes of the lower burning rate is attributed to the accumulation of the silica ash at the surface results from the deposition of silica particles, one of the major combustion products of silicone oligomers in the gas phase. [2]

REQUIREMENTS

The requirements for cables differ depending on the application and are especially strict in tunnels were traffic and people can pass.

Fire requirements in a tunnel

The requirements for fire resistant cables are outlined in European Standard EN 1991-1-2 [3]. A tunnel has to be constructed in such a way that its construction does not put human life at risk. Personnel must be able to save themselves and any rescue team should not be endangered. Additionally the fire should not transfer to an adjacent structure.

Figure 1 gives an example of the complexity of cables installed in a tunnel in the Alps. (Courtesy of Symalit AG, Switzerland)