Catalyst alternatives to replace DBTDL to crosslink silane grafted polyethylene

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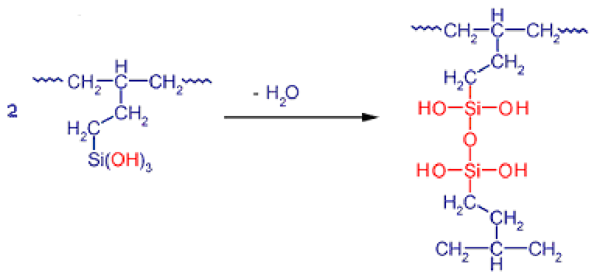
Silane crosslinked polyethylene is commonly used as insulation of low voltage cables as it allows insulation to withstand 90°C in normal service conditions and 250°C in case of short-circuit. However, crosslinking of silane grafted polyethylene is slow, even if a heat treatment is used in presence of moisture (for example, hot water bath). That is why, a catalyst which is able to increase the speed of the two stages of crosslinking is needed.

1st stage: Hydrolysis

Hydrolysis to form silanol groups

2nd stage: Condensation

Condensation to create siloxane bonds



The most common catalyst, named DBTDL (DiButyl Tin DiLaurate), is classified as reprotoxic 1B and mutagenic 2. For several years, studies have dealed with alternatives to replace DBTDL. Some of these catalysts were also studied to crosslink insulation at ambient conditions instead of using a hot water bath.

Two categories of catalysts are presented in the literature: acid (Lewis and Brönsted) and base. Among base catalysts, the literature deals with amine and hydroxide compounds. Among Brönsted acid catalysts, carboxylic and sulfonic acid compounds are presented as possible alternatives. Finally, among Lewis acids, metal-organic compounds (Cu, Zn, Co, etc.) and tin-organic compounds (other than DBTDL) were studied.

After making a state of the art of the compounds already studied to replace DBTDL, some of the most interesting ones were tested in an insulation formulation and were compared to DBTDL.