PROPERTIES – YOU NEED

SOME KEY PROPERTIES OF EBA BASED WIRE AND CABLE COMPOUNDS

Flexibility

One of the most important features of a cable is flexibility. Flexibility requires the polymers constituting the cable to have some elastomeric character. Therefore, rubber based materials like EPDM, EPM and NBR have been being used widely in wire and applications. However, due to its high cost EPDM and other rubbers came under pressure from elastomeric thermoplastics like ethylene butyl acrylate (EBA), ethylene vinyl acetate (EVA) and m-PE plastomers. Among these m-PE plastomers require a premium price due to their elaborate production technology, whereas EBA and EVA are priced relatively low due to their simple production technology. Nowadays, wire and cable formulations based on EBA or EBA / EPDM blends are very common. Lucofin® 1400HN, Lucofin® 1400MN, Lucofin® 1400DF and Lucofin® 1400FN as offered by LUCOBIT AG are typical ethylene butyl acrylates (EBA).

Crosslinkability

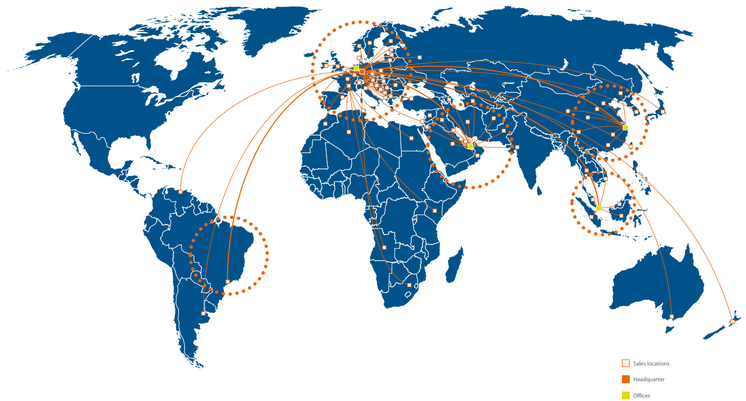
EPDM and other rubber based materials are vulcanized in order to increase maximum service temperature, enhance chemical as well as stress cracking resistance and improve mechanical properties during end usage. Methods of vulcanization or curing include steam, hot liquids (eutectic mixtures), microwave and hot air. Polyolefinic materials offer a very similar method of upgrading their properties: crosslinking. The resulting plastic is called cross-linked PE (XLPE). Two technologies were initially employed: crosslinking started by thermal decomposition of organic peroxides or by electron beam irradiation, both as sources of polymer radicals that combine to form a carbon-carbon bond. Peroxide crosslinking can be achieved via steam cure, nitrogen cure or pressurized liquid. Typical residence times are from 25 s for thin-walled wire, to several minutes for high-voltage power cable. All these methods involve higher heat than the melt heat to cause the peroxide in the plastic to decompose into a reactive radical and initiate the curing cycle.

Radiation crosslinking is performed by passing the wire or cable through a beam of electron radiation. Usually, the full dosage is not applied in a single pass because of the rapid temperature increase that accompanies electron beam exposure since it would damage the product. Subsequently, it was found that vinyl or acrylyl organosilanes could be grafted to PE using traces of organic peroxide, typically in an extruder, and the product then crosslinked by contact with warm water, causing hydrolysis of alkoxy groups on silicon. The resultant Si-OH groups could then be condensed to Si-O-Si linkages with catalysts such as dibutyltin dilaurate or diacetate.

As high pressure tubular reactor resins all Lucofin® grades offered by LUCOBIT AG offer excellent crosslinkability in all three crosslinking technologies as described above. Therefore, crosslinked Lucofin® based compounds are challenging vulcanized EPDM based compounds with respect to both technical properties and commercial attractiveness.

LUCOBIT
THERMOPLASTIC POLYOLEFINS

LOCATIONS



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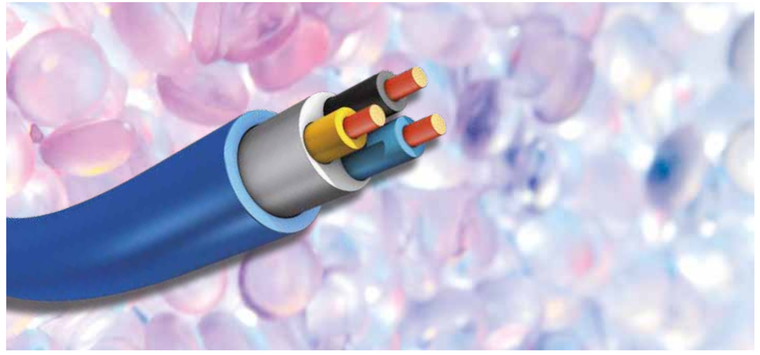
LUCOBIT
THERMOPLASTIC POLYOLEFINS

FLEXIBLE POLYMERS

WIRE & CABLE

... we make better polymers

LUCOBIT RESINS AND THEIR USE IN WIRE AND CABLE APPLICATIONS



GENERAL

The use of plastics in the production of wire and cable is known for more than a century. Originally, the field was dominated by elastomers – first natural rubber chemically modified and later on synthetic rubbers. With the arrival of thermoplastics in the 1930s and their widespread use after the second world war, this group of materials also conquered the world of wire and cable and more by more replaced elastomers.

The bulk of the thermoplastics used in wire and cable are with PEs and PVCs. The PEs offer excellent insulating ability with moisture and chemical resistance, flexibility and light weight.

Compared to the PEs, the vinyls are heavier, flexible and are somewhat poorer insulators. Polyethylene belongs to the family of polyolefin resins.

It is a simple polymer with repeating CH_2CH_2 structure. It is an incredibly versatile polymer with almost limitless variety due to copolymerization potential, a wide density range, and a molecular weight that ranges from low to very high.

The following table shows the LUCOBIT products and their main properties fit for use in foam applications:

LV/MV CABLE INSULATION • SEMI CONDUCTIVES • HFFR • BEDDING COMPOUNDS • JACKETING • CELLULAR

PRODUCT	MATERIAL	COLOR	SHORE A	MFR[1] 190°C / 2.16 KG
Lucofin® 1400HN	EBA (16 % BA)	natural	90	1.4
Lucofin® 1400HN Powder	EBA (16 % BA)	natural	90	1.4
Lucofin® 1400MN	EBA (17 % BA)	natural	88	7
Lucofin® 1400MN Powder	EBA (17 % BA)	natural	88	7
Lucofin® 1494M	MAh grafted EBA (17 % BA)	natural	92	7
Lucofin® 1494H	MAh grafted EBA (16 % BA)	natural	90	1.8
Lucopren® EP 1500H-90[2]	PP | EPM	natural	30[4]	0.6
Lucopren® EP 1500M-90[2]	PP | EPM	natural	30[4]	8
Lucofin® 7410HFFR[3]	EBA/ATH	natural	52[4]	6
Lucofin® 7440HFFR[3]	EBA/MDH	natural	52[4]	6.5

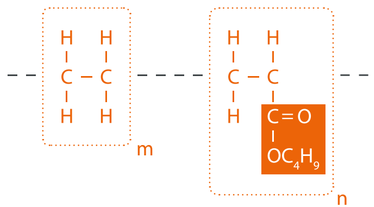
[1] average [2] MFR 230 °C / 2.16 kg [3] in development [4] Shore D

LUCOBIT PRODUCTS

Insulation, jacketing, bedding, semiconductives, HFFR, low / mid / high voltage. LUCOBIT products serve the world of wire & cables in many ways granting:

- Easy processability and high melt strength
- Good aging properties at elevated temperatures during usage
- High softness / flexibility
- Superior crosslinkability by silanes, peroxides or e-beam

The majority of LUCOBIT products is based on ethylene butyl acrylate copolymer (EBA). The repeat unit of EBA copolymers is shown in the figure. This structure explains many of its unique properties as explained on the next page.



CASE STUDY

CUSTOMER

Global expert in cables and cabling system.

PREVIOUS SITUATION

HFFR compound based on EVA and ATH.

SOLUTON NOW

HFFR compound based on Lucofin® 1400MN and MDH.

BENEFITS TO THE CUSTOMER

- Productivity increase of 25 % because EBA / MDH compounds can be extruded up to 300 °C during both compounding and cable manufacturing whereas extrusion melt temperatures of EVA / ATH compounds are restricted to temperatures below 200 °C
- Improved low temperature properties due to low Tg of EBA
- Better aging properties and improved hydrolysis resistance

ADVANTAGES OF LUCOBIT PRODUCTS COMPARED TO PLASTOMERS AND EVA

The stream of truth flows through its channels of mistakes. The speciality plastics based on flexible polyolefins which are marketed and sold by LUCOBIT AG under the trade names Lucofin® types are doubtless products that you have long known to be quality materials. Particularly with a view to our grafted and non-grafted EBA grades, our distribution partners repeatedly tell us that there is a certain information gap as far as cost-effectiveness is concerned. What may at first glance appear to be more expensive compared with other polymer systems does in fact almost always, on closer inspection, prove to be the cheapest solution overall and in the long term.

It is essential here not to interpret the performance of a product solely in terms of the price per unit of quantity. You only obtain an objective result if you examine all technical aspects. In terms of our EBA grades competing on both a commercial and technical basis with EVA, plastomers, but also EBA products from other manufacturers, the Lucofin® materials are proving time and time again to be the optimum solution for an increasingly large number of our customers' end applications.

A sustainable assessment must take account not just of the simple formula of „dosage x price" but also the value attached to the technical advantages afforded from the use of Lucofin® EBA. The following table illustrates the key properties and the resulting advantages of Lucofin® 1400HN and 1400MN. If all of these factors impacting on cost effectiveness are assessed in an objective and unbiased way, it is ultimately apparent that Lucofin® EBA materials usually constitute the better solution.