LUCOBIT
THERMOPLASTIC POLYOLEFINS

FLEXIBLE POLYMERS

COMPOUNDING & MASTERBATCH

... we improve your polymer

LUCOBIT RESINS AND THEIR USE IN COMPOUNDING APPLICATIONS

GENERAL

Compounding of plastics is the most important upstream technology used in the industry. It is estimated that of the 200+ million tons of plastics consumed globally roughly 65+% are compounded to render the initial polymer suitable for downstream processing into valuable products. This process step also includes the inclusion of many different and targeted additives so that e.g. expected color schemes, light stabilization, anti-ageing properties etc. can be met. Here, the realm of masterbatch production begins with many of its specialized and important intermediates.

A very significant market to be mentioned here specifically is the 'Cable & Wire' application. Today, especially thermoplastic materials are used replacing the more rubbery, elastomeric materials from the past. Polyethylene (PE) and poly-vinylchloride (PVC) are the most abundant polymers used in and for this application – pure, compounded or even as part of a masterbatch. While PE exhibits excellent insulation properties, chemical resistance, flexibility and little weight PVC shows somewhat reduced performance in some these metrics but superior in others.

LUCOBIT AG's Lucofin® products give you the best of both worlds: our thermoplastic copolymer based on ethylene and butylacrylate (EBA) depicts incredible versatility ranging from flexibility, high temperature stability, chemical resistance etc. to name only a few.

Lucofin® 1400MN and Lucofin® 1492M HG are used successfully in wood-plastic-composite materials (WPC Compounds). Aside from the already known range of applications in the construction industry e.g. for decking-profiles, other areas of application are becoming more prominent such as injection molding. Lucofin® 1492MHG as adhesive or coupling agent/layer, possibly in combination with Lucofin® 1400HN/MN/PN as polymer modifiers, can improve the handling and the mechanical properties as well as the long-term behavior of the resulting blends in a much more sustainable way.

The following example illustrates these effects: blending a PP (polypropene) based compound with 50% wood fibers, the addition of 2% Lucofin® 1492M HG as coupling agent and 8% Lucofin® 1400MN can eliminate the need for a normally required release agent. Simultaneously, applied extrusion pressure can be reduced and the mold-release speed can be improved. The lower melting point, a higher polydispersity as well as the presence of long-chain branching in Lucofin® are advantageous. Use of Lucofin® 1492M HG results in an enhanced (notch-) impact strength at room – as well as at temperatures of -15 °C and – 28°C.

A reduced water absorption as well as a reduced moisture expansion after water absorption (after conditioning as well as under dry conditions) result in significantly improved long-term properties when used outside or while exposed periodically to rain and UV radiation (sunlight).

The following table shows LUCOBIT AG products with their main properties suitable for use in compounding applications:

PRODUCT	MATERIAL	COLOR	SHORE A	MFR[1] 190°C / 2.16 KG
Lucofin® 1400HN	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® 1492M HG	MAh grafted EBA (17 % BA)	natural	92	5[2]
Lucofin® 1400PN	EBA (17 % BA)	natural	90	15

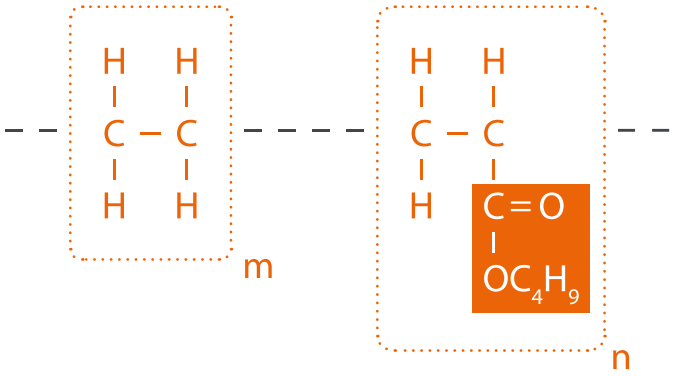
[1] average [2] example value

LUCOBIT PRODUCTS

LUCOBIT AG products are the right choice for compounding, e.g. Cable & Wire compounds or masterbatch. Fillers, HFFR additives, colour pigments and other additives can be easily added. Here some examples why Lucofin® is used in compounding:

- Easy processability and high melt strength
- High filler loading capacity e.g. ATH (Aluminum trihydrate), MDH (Magnesium dihydroxide), HFFR, chalk, carbon black…
- Extrusion melt temperature up to 300 °C resulting in increased production output
- Limited ageing at elevated temperatures
- US FDA and European Food Approval Certificates
- Bestow flexibility and impact resistance and/or softness to otherwise brittle polymers e.g. PA, PA/ABS, PBT, PET,…
- Easily crosslinked through all known crosslinking processes

The majority of LUCOBIT AG products are based on EBA = Ethylenebutylacrylate. The repeat unit of this copolymer is shown in the Figure to your right. This structure explains many of its unique properties as explained on the next page.



CASE STUDY ONE

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 260 °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

CASE STUDY TWO

CUSTOMER

Globally oriented masterbatch company.

PREVIOUS SITUATION

LDPE based masterbatch with combined pigment and stabilizer concentration of 40 %.

SOLUTON NOW

Lucofin® 1400MN based masterbatch with combined pigment and stabilizer concentration of 60 %.

BENEFITS TO THE CUSTOMER

- Productivity increase of 30 % due to higher concentration of pigments and stabilizers
- Improved processing with 10 % less scrap during the masterbatch compounding
- Better match of masterbatch resin with mother compound resin resulting in lower brittleness temperature of final extrudate (waterproofing membrane)

PRODUCTS –
THAT MAKE YOU SUCCESSFUL

ADVANTAGES OF LUCOBIT AG PRODUCTS

LUCOBIT AG markets specialty plastics based on flexible polyolefin copolymers under the trade name Lucofin®. For many years, these proved to be again and again as high quality products our customers learned to appreciate and value.

Over time, we added grafted and non-grafted and specialty grades to our product portfolio. Many of our customers tested them and showed their exemplary cost-effectiveness retaining expected characteristics in most applications compared to other alternatives fulfilling required technical specifications. All required technical specifications were fulfilling: Especially in comparison to other plastomers, Lucofin® EBA's proved to be the superior solution.

The following Figure illustrates and exemplifies key properties and the resulting advantages of Lucofin® 1400 HN, 1400 MN, 1400 PN and their grafted equivalents. Taking these factors into account, cost effectiveness of Lucofin® EBA's becomes apparent and consequently constitutes the best solution.

SOME KEY FEATURES OF EBA BASED WIRE & CABLE APPLICATIONS AND COMPOUNDING

FLEXIBILITY

Polymers for cable and wire applications require elastomeric properties. Rubbers like EPDM, EPM, or NBR are widely employed. In recent years, these rubber materials have been replaced by elastomeric thermoplasts like ethylenebutylacrylates (EBA), ethylenevinylacetate (EVA), metallocene-polyethylene (m-PE) etc. in many cases. Among these, EBA and EVA prove to be even more cost-effective since their production requires less elaborate technologies. Today, many wire & cable formulations are based on our Lucofin® 1400HN and 1400 MN EBAs or EBA/EPDM blends.

CROSSLINKABILITY

EPDM and other rubbers undergo crosslinking by vulcanization (by steam, hot air, radiation, sulfur, …) to improve their properties eg. maximum handling temperature, enhanced chemical and stress crack resistance, better mechanical properties of the final products.

The polyolefinic equivalents are based on similar methods resulting in so-called cross-linked PE (XLPE). Peroxide, organosilane and electron beam irradiation are the preferred methods of choice. These XLPEs proved to be excellent replacement plastics for most crosslinked rubbers but improved underlying economics. Our Lucofin® EBAs used in these applications not only match but excel on most of the customers' desired metrics.

IMPACT MODIFICATION

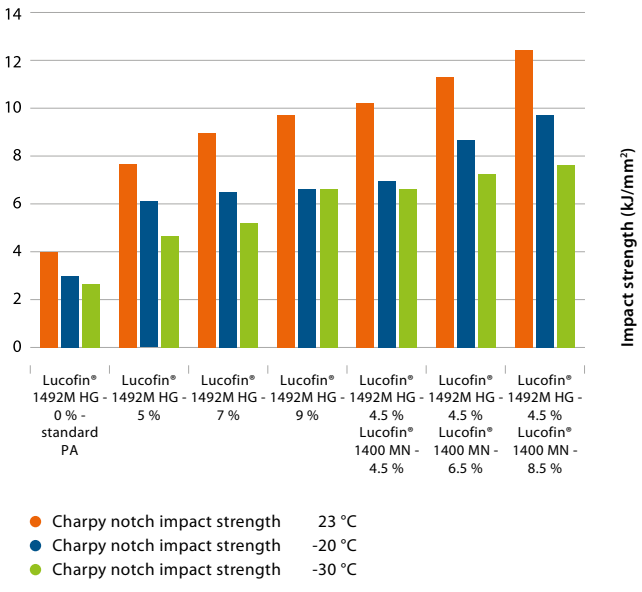
Commercial polyamides (PA-6, PA-66,…) are tough and ductile materials with a high tensile elongation at break, high drop weight impact etc. Exposure to water often improves toughness due to the plasticization effect. However, PAs can also be brittle and lack stress crack resistance (as shown by the notched Izod and Charpy impact tests).

Here, Lucofin® EBAs may be the perfect modifier especially our grades 1400MN and 1492M HG (which is its maleic anhydride (MAh) grafted equivalent) suitable for highly polar polymers and polymer blends. For PAs, typical EBA concentration range from 5-25wt % to maximize toughness while simultaneously retaining a high level of tensile strength and heat deflection temperature. Not-reinforced or glass-fiber reinforced PAs can be modified as well.

The Lucofin® modified PA blend uniquely combines high-notch Izod Impact and drop weight impact strength coupled with an excellent balance of E-modulus, tensile strength, heat, solvent and abrasion resistance. Consequently, it is very well suited for many engineering and metal replacement applications.

The below shown Figure exhibits the increasing impact strength with increased levels of Lucofin® EBAs added to PA.

Charpy notch impact strength at various temperatures of non-filled PA 6 injection moulded samples compounded with various amounts of Lucofin® 1492M HG and Lucofin® 1400MN according to STN EN ISO 179



LUCOBIT
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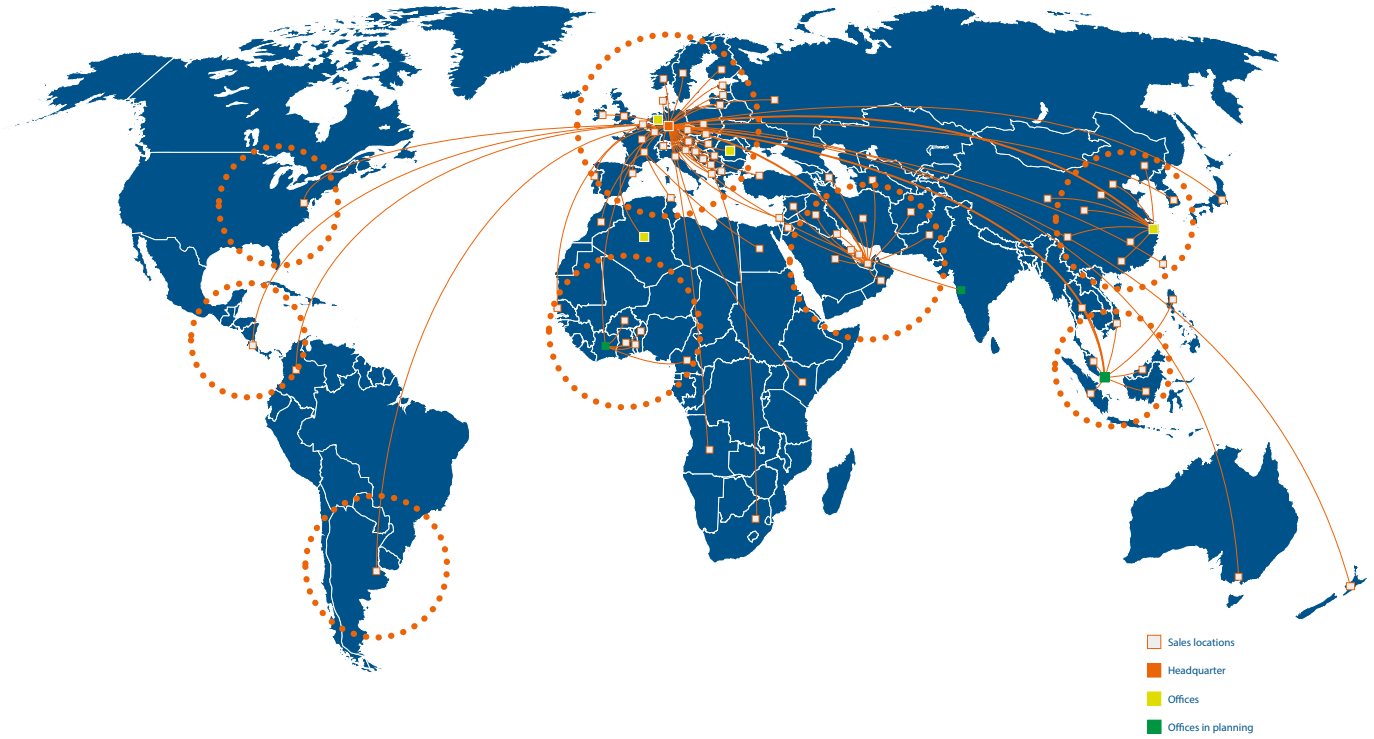
LOCATIONS



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