

## IMPACT MODIFICATION OF POLYAMIDES WITH LUCOFIN®

### 1494M – POSSIBLY IN BLEND WITH LUCOFIN® 1400HN / MN



Commercial polyamides such as PA-6 and PA-66 are generally regarded as tough and ductile materials since they exhibit high tensile elongation to break and high drop weight impact strengths. They become even tougher after equilibration with ambient humidity due to the plasticization effect of the absorbed water.

However, under conditions of low humidities and / or low temperatures due to the lack of plasticizing water and under conditions of stress concentration such as in the presence of sharp notches or cracks, polyamides exhibit brittle failure. This property, commonly evaluated as notched Izod or Charpy impact tests, indicates that unmodified polyamides exhibit relatively low energies for crack propagation.

The impact performance of polyamides can be improved by compounding in modifying elastomeric components, such as Lucofin® 1494M and Lucofin® 1400MN.

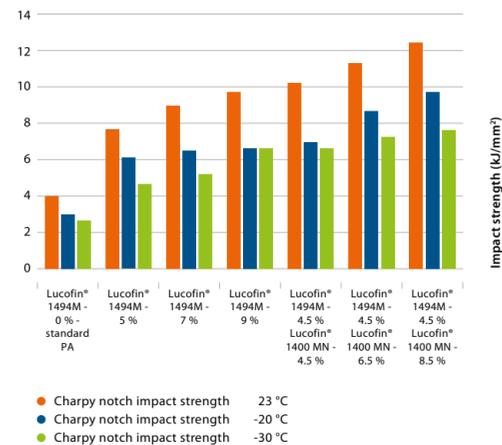
Lucofin® 1494M is a Maleic anhydride (MAh) grafted variation of Lucofin® 1400MN. Due to the innovative reactive extrusion technology the extremely polar MAh in Lucofin® 1494M is more active than in comparable competition grades and compatibilizes readily with all kinds of polyamides. Commercial impact modified polyamides typically contain 5 % to 25 % of Lucofin® 1494M to maximize the toughening efficiency while retaining a high level of tensile strength and heat deflection temperature. Unreinforced PA as well as glass fibre reinforced PA can be impact modified likewise.

Lucofin® 1494M impact modified PA blends indeed offer a unique combination of high notched Izod impact and drop weight impact strengths, coupled with a good balance of modulus, tensile strength, heat, solvent and abrasion resistance characteristics. These properties are suitable for many engineering and metal replacement applications.

In case of cost-driven applications the proportion of Lucofin® 1494M in a PA formulation may be partly substituted by Lucofin® 1400HN or Lucofin® 1400MN without sacrificing too much impact modification. This procedure is possible because of the polar nature of the non-grafted Lucofin® 1400HN / Lucofin® 1400MN.

Below table clearly shows that by compounding standard PA grades with increasing amount of Lucofin® 1494M an increasing impact strength can be observed which often is the goal. If cost reduction is desired partial replacement of Lucofin® 1494M by Lucofin® 1400MN is possible without losing too much technical advantage.

Charpy notch impact strength at various temperatures of non-filled PA 6 injection moulded samples compounded with various amounts of Lucofin® 1494M and Lucofin® 1400MN according to STN EN ISO 179



## LOCATIONS



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### Note

The information provided in this document is based on our product tests and present technical knowledge. It does not release purchasers from the responsibility of carrying out their receiving inspections. Neither does it imply any binding assurance of suitability of our products for a particular purpose. As LUCOBIT cannot anticipate or control the many different conditions under which this product may be processed and used this information does not relieve processors from their own tests and investigations. Any proprietary rights as well as existing legislation shall be observed.

## FLEXIBLE POLYMERS

### COMPOUNDING



... we make better polymers

# LUCOBIT RESINS AND THEIR USE IN COMPOUNDING APPLICATIONS



# PRODUCTS – THAT MAKE YOU SUCCESSFUL



## GENERAL

Of all the tens of thousands plastics available worldwide that are used by the plastic converter industry most undergo compounding in order to meet product requirements. It is estimated that over 65 wt-% of the 200 million tons consumed worldwide are compounded. Compounding is a very large and important market.

The thousands of different additives and other ingredients used in the compounds improve the plastics performance

during processing and / or meet the many different product requirements, including cost restraints. The composition of the compound is dictated by the requirements of the converter's application. Among the very many different additives are pigments, dyes, fillers, UV stabilizers, coupling agents and others.

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

### IMPACT MODIFIER • CARRIER FOR COLOUR MASTERBATCHES • ROOFING COMPOUNDS • HIGHLY FILLED & HFFR COMPOUNDS

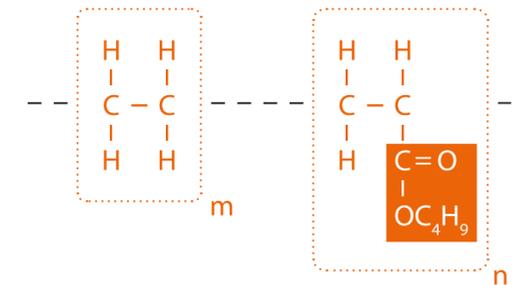
PRODUCT	MATERIAL	COLOR	SHORE A	MFR <sup>1)</sup> 190°C / 2.16 KG
Lucofin® 1400HN	EBA (16 % BA)	natural	90	1.4
Lucofin® 1400HN Powder	EBA (16 % BA)	natural	90	1.4
Lucofin® 1400MN	EBA (17 % BA)	natural	88	7
Lucofin® 1400MN Powder	EBA (17 % BA)	natural	88	7
Lucofin® 1494M Powder	MAh grafted EBA (17 % BA)	natural	92	5
Lucofin® 1494M	MAh grafted EBA (17 % BA)	natural	92	7
Lucofin® 1494H	MAh grafted EBA (16 % BA)	natural	90	1.8
Lucofin® 1400SL	EBA (16 % BA) • slip agent (0.2 %)	natural	90	1.4
Lucopren® EP 1500H-90 <sup>2)</sup>	PP   EPM	natural	30 <sup>3)</sup>	0.6
Lucopren® EP 1500M-90 <sup>2)</sup>	PP   EPM	natural	30 <sup>3)</sup>	8

<sup>1)</sup> average <sup>2)</sup> MFR 230 °C / 2.16 kg <sup>3)</sup> SHORE D

## LUCOBIT PRODUCTS

LUCOBIT products are the right choice for your compound. They finetune highly filled and HFFR compounds, colour as well as additive masterbatches, roofing and impact modified compounds. LUCOBIT products impart:

- High filler loadings, such as ATH (Aluminium trihydrate) or chalk
- Extrusion melt temperature up to 300 °C and therefore increased production output
- Food approval certificates
- Flexibilization and impact modification to otherwise brittle plastics (PA, PA / ABS, PBT, PET)



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

Globally oriented masterbatch company.

### PREVIOUS SITUATION

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

### SOLUTION 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)

## ADVANTAGES OF LUCOBIT PRODUCTS COMPARED TO PLASTOMERS AND EVA

The speciality plastics based on flexible polyolefins which are marketed and sold by LUCOBIT AG under the trade name 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 techni-

cal 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 of 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.

