Polycarbonate and PMMA Sheets
for a transparent view with
Kafrit Masterbatches and Compounds

Giving Life to Plastic
Kafrit Group is a leading producer of Masterbatches and Compounds for the plastics industry and currently employs more than 400 people. In 2017, the Group achieved 216 million $ turnover with an available capacity of more than 82,000 MT. Moreover, the company is active on a global scale and has set up production sites all over the world. All of this began in 1973 when the company was founded in Israel. Since then, the company has grown primarily via acquisition.

Today, the Kafrit Group incorporates Kafrit Industries (1993) Ltd. in Israel, CONSTAB Polyolefin Additives GmbH in Germany, China’s Suzhou Constab Engineering Plastics Co. LTD, Polyfil Inc. in the USA and the Canada-based Kafrit NA Ltd. With nearly 50 years of experience in the plastics processing industry, the company can draw on high levels of expertise and technical know-how. Kafrit Group places a high value on sustainability and has made it one of the cornerstones of our corporate strategy. Our unbridled dedication to environmental, social and financial issues makes us one of the leading business partners in the plastics industry. Our customers value our passion and appreciate our ecological awareness and social commitment. Moreover, they recognize our world leading services and consider our products as among the best within our industry.

We develop and produce cost-efficient solutions which will enhance the completion of high-quality end products in many areas of the plastics industry, such as packaging films (BOPP, BOPE, CPP, PE), PC sheet, agricultural films and derivatives, biopolymers, flame retardant applications, PEX, pipes, fibers and nonwovens. Along with many other products, the Kafrit Group supplies the following Masterbatches and Compounds:

- Acid Scavenger
- Antiblock
- Antidust
- Antifog
- Antiglare
- Antimicrobial Agent
- Antioxidant
- Antislip
- Antistatic
- Barrier MB
- Cavitating Agent
- Color Concentrate
- Ecoceol®
- Flame Retardant
- Filter
- Foaming Agent
- IR Absorber
- Light Stabilizer
- Lubricant
- Matting Agent
- Metal Deactivator
- Modifier
- Nucleating Agent
- Optical Brightener
- Paper-Ike Compound
- Peel Compound
- Processing Aid
- Purge Agent
- Release Agent
- Slip-Antiblock
- Slip-Antistatic
- Slip Agent
- Tracer MB
- UV Absorber
- UV Blocker
- White Masterbatch
- White Cavitated

Research that takes us to the top
Throughout our company history, research and development have always been a key area of our expertise. Kafrit employs a staff of more than 400 people that work on innovative products and make use of our vast pool of knowledge that we developed in nearly 50 years of experience in the plastics industry. Our experts optimize and develop additive concentrates, flame retardants, color concentrates, and compounds for various applications. Kafrit enjoys a close partnership with renowned research institutions at the Shenkar University in Israel and at different universities in Germany. Moreover, we maintain a strong cooperation with well-known suppliers including machine manufacturers that do recommend our products for use in combination with their machines.

Our vision: We aim to be the preferred technological partner of the plastics industry by continually supplying our global customers with innovative and high quality solutions that are fitted to their specific needs.
Polycarbonate

Kafrit UV compounds are designed and tailored according to the customer’s specifications and Kafrit’s vast experience in this field. All Kafrit solutions are colored with a bluish tint to hide the UVA yellow shade, and contain optical-brightener to enable layer identification by the sheet producer. Kafrit is offering unique coloring abilities to meet customer demands.

The compound flow properties are a key factor in uniform and stable layer distribution across the sheet’s width. The Cap Layer flow is determined by the PC resin type, lubrication system level and, most importantly, the UV absorbers types and level.

Kafrit solutions offer an optimized MVI based on years of experience. Our know-how allows us to offer a variety of MVIs according to the final application and production process. We use different types of UVA compounds and Masterbatches to insure optimal UV protection, process optimization and the best value each and every customer needs for their products.

The UVA types differ in their chemistry, price and plate out level. Kafrit recently developed a new line of products that significantly improves performance in terms of plate out. Our new improved technology allows sheet producers to increase significantly the working interval between cleaning, therefore adding significant value to production efficiencies.

1. UV Cap Layer

Most PC sheets are protected by a thin co-extruded layer (Cap Layer). This layer is based on PC resin, enriched with a high level of UV absorbers. The recommended layer thickness is taking into consideration the layer erosion over the service life and the UV additive optical density, so no harmful UV light will penetrate the Cap Layer to the unprotected Polycarbonate.

<table>
<thead>
<tr>
<th>Code</th>
<th>Recommended layer thickness</th>
<th>Duration</th>
<th>Geographical area</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>UVA 60J780 PC Bluish</td>
<td>50 µm</td>
<td>10 Years</td>
<td>Europe or Moderate Climate</td>
<td></td>
</tr>
<tr>
<td>UVA 60J720 PC Bluish</td>
<td>35 µm</td>
<td>10 Years</td>
<td>Europe or Moderate Climate</td>
<td></td>
</tr>
<tr>
<td>UVA 60K18 PC Bluish</td>
<td>50 µm</td>
<td>10 Years</td>
<td>South East Asia</td>
<td></td>
</tr>
<tr>
<td>UVA 60K20 PC Bluish</td>
<td>50 µm</td>
<td>15 Years</td>
<td>Europe or Moderate Climate</td>
<td></td>
</tr>
<tr>
<td>UVA 60K20 PC Bluish</td>
<td>50 µm</td>
<td>10 Years</td>
<td>Australia, Dubai, Arizona or Severe Climate</td>
<td></td>
</tr>
<tr>
<td>UVA 60K25 PC Bluish</td>
<td>50 µm</td>
<td>10 Years</td>
<td>Europe or Moderate Climate</td>
<td>Improved plate out performance</td>
</tr>
<tr>
<td>UVA 60K28 PC Bluish</td>
<td>50 µm</td>
<td>15 Years</td>
<td>Australia, Dubai, Arizona or Severe Climate</td>
<td>Improved plate out performance</td>
</tr>
<tr>
<td>UVA 60K28 PC Bluish</td>
<td>50 µm</td>
<td>20 Years</td>
<td>Europe or Moderate Climate</td>
<td>Improved plate out performance</td>
</tr>
</tbody>
</table>

2. Anti-Glare

The purpose of this product group is to eliminate the sheets’ glossy surface appearance. As this is a surface phenomena, the AG products are always combined with UVA and applied to the sheets in the same manner as the UV cap layers.

The effect obtained can also be referred to as a “matt-effect”. The AG products are based on cross-linked polymeric spheres (similar to the light diffuser additives) that create a kind of micro-structure on the surface and, as such, interfere with the glossy appearance. The AG products contain different types of polymeric spheres, with different diameters. Both parameters are very important factors in the AG’s performance, appearance and processability. It is recommended to apply the AG compounds at a layer thickness of 40-50 µm to get the best effect.

<table>
<thead>
<tr>
<th>Code</th>
<th>Surface effect</th>
<th>Max processing temp</th>
<th>Duration at Moderate Climate, 50 µm layer</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>UVA 69600 PC Blue and Diffuser</td>
<td>fine</td>
<td>300º</td>
<td>15 Years Milky/Haze</td>
<td></td>
</tr>
<tr>
<td>UVA 6C670 PC Blue and Diffuser</td>
<td>fine</td>
<td>300º</td>
<td>10 Years Milky/Haze</td>
<td></td>
</tr>
<tr>
<td>UVA 6C23 PC Antiglare and Bluish</td>
<td>fine</td>
<td>270º</td>
<td>10 years Matt Effect</td>
<td></td>
</tr>
<tr>
<td>UVA 6C68 PC Antiglare and Bluish</td>
<td>rough</td>
<td>270º</td>
<td>10 years Matt Effect</td>
<td></td>
</tr>
</tbody>
</table>

3. Anti-Scratch

Most PC sheets are protected by a thin co-extruded layer (Cap Layer). This layer is based on PC resin, enriched with a high level of UV absorbers. The recommended layer thickness is taking into consideration the layer erosion over the service life and the UV additive optical density, so no harmful UV light will penetrate the Cap Layer to the unprotected Polycarbonate.

<table>
<thead>
<tr>
<th>Code</th>
<th>Surface effect</th>
<th>Max processing temp</th>
<th>Duration at Moderate Climate, 50 µm layer</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>UVA 60J71 PC UV Anti-Scratch NEW!</td>
<td>rough</td>
<td>300º</td>
<td>20 Years Matt Effect</td>
<td></td>
</tr>
</tbody>
</table>
### 4. Heat Management

In today’s world energy savings are essential and play an important role in designing the world’s future. The major global trends such as climate changes, mobility, growing population and increasing urbanization require by better solutions to insure: zero emissions, low energy building, efficient and lightweight transportation, better housing structure and system and more efficient public infrastructure.

More than 50% of the light is invisible and translates into heat (NIR). This heat is accumulated under covered spaces and requires energy in order to control the temperature under such structures.

Kafrit NIR PC Masterbatches are designed to insure that NIR is reflected and therefore allows architects and other users to insure that covered spaces are efficient and cost effective. With our versatile portfolio while using unique proprietary we offer a wide range of optimized solutions to answer tomorrow's demand.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>LDR</th>
<th>Solar Performances</th>
<th>LT</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR 0F680 PC</td>
<td>Standard NIR MB; transparent with greenish appearance; based on unique technology; Kafrit proprietary.</td>
<td>3% Ø 1.3 mm chip</td>
<td>SHGC = 0.61 SC = 0.70 LSC = 1.08</td>
<td>66%</td>
</tr>
<tr>
<td>IR 6B491 PC</td>
<td>Modification of IR 0F680 PC, combined with blue pigment.</td>
<td>3% Ø 1.3 mm chip</td>
<td>SHGC = 0.58 SC = 0.67 LSC = 1.01</td>
<td>59%</td>
</tr>
<tr>
<td>IR 0K320 PC</td>
<td>NIR based on new chemistry NIR absorber; very transparent with slightly bluish shade.</td>
<td>3% Ø 1.3 mm chip</td>
<td>SHGC = 0.67 SC = 0.77 LSC = 1.23</td>
<td>82%</td>
</tr>
<tr>
<td>IR 0K220 PC</td>
<td>New combination of NIR additives based on advanced technology; covers large area of the energetic part in the NIR region.</td>
<td>3% Ø 1.3 mm chip</td>
<td>SHGC = 0.63 SC = 0.72 LSC = 1.29</td>
<td>81%</td>
</tr>
</tbody>
</table>

**SHGC** solar heat gain coefficient
**SC** shading coefficient
**LT** light transmission

**LSG** LT/SHGC

**Additional IR Products**

- Designed for a co-extrusion layer of 50 µ, under the UV layer.
- Designed for a co-extrusion layer of 50 µ combined with UVA for a single-layer implementation.

“I greatly appreciate the reliable handling and top quality. The technical support is excellent and the staff are always there to help.”
5. Light Diffuser

5.1 Polycarbonate diffusers

<table>
<thead>
<tr>
<th>Code</th>
<th>Properties</th>
<th>Application</th>
<th>LDR</th>
<th>LT</th>
<th>H</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIF 0J160 PC</td>
<td>High efficiency.</td>
<td>MW, Corrugated</td>
<td>3.0%</td>
<td>3 mm</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>DIF 09540 PC</td>
<td>High efficiency.</td>
<td>MW, Corrugated</td>
<td>1.0%</td>
<td>3 mm</td>
<td>57</td>
<td>100</td>
</tr>
<tr>
<td>DIF 0K78D PC</td>
<td>High thermal stability.</td>
<td>Solid</td>
<td>2.0%</td>
<td>3 mm</td>
<td>71</td>
<td>100</td>
</tr>
<tr>
<td>DIF 0K78D PC</td>
<td>High thermal stability.</td>
<td>Solid</td>
<td>3.5%</td>
<td>3 mm</td>
<td>64</td>
<td>100</td>
</tr>
<tr>
<td>DIF 09681 PC</td>
<td>Excellent LT/ Haze ratio (LED).</td>
<td>MW, Solid, Corrugated</td>
<td>3.0%</td>
<td>3 mm</td>
<td>79</td>
<td>100</td>
</tr>
<tr>
<td>DIF 09681 PC</td>
<td>Excellent LT/ Haze ratio (LED).</td>
<td>MW, Solid, Corrugated</td>
<td>1.5%</td>
<td>3 mm</td>
<td>88</td>
<td>100</td>
</tr>
<tr>
<td>DIF 10981 PC</td>
<td>High efficiency and white shade (Opal).</td>
<td>MW, Corrugated</td>
<td>2.0%</td>
<td>3 mm</td>
<td>54</td>
<td>100</td>
</tr>
</tbody>
</table>

All measurements were done on 1.2 mm plaque.

5.2 PMMA diffusers

<table>
<thead>
<tr>
<th>Code</th>
<th>Properties</th>
<th>Application</th>
<th>LDR</th>
<th>LT</th>
<th>H</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIF 0R76 MMA</td>
<td>High thermal stability.</td>
<td>Solid</td>
<td>3.0%</td>
<td>3 mm</td>
<td>84</td>
<td>100</td>
</tr>
<tr>
<td>DIF 00376 MMA</td>
<td>High thermal stability, excellent performance, new developed.</td>
<td>Solid</td>
<td>4.0%, 1.3 mm</td>
<td>94,5</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>DIF 00498 MMA</td>
<td>Excellent performance, new developed.</td>
<td>Solid</td>
<td>3.0%, 1.3 mm</td>
<td>89</td>
<td>100</td>
<td>2</td>
</tr>
</tbody>
</table>

All measurements were done on 1.2 mm plaque.

6. Flame Retardant

The Single Burning Item standard (SBI) EN 13823 is the main building standard for PC sheets in Europe. The same goes for the ASTM E84 in North America. In addition to the various required standards in different countries, the PC sheet geometry, type of polycarbonate resin mixed with the FR MB, thickness and weight have an important impact on the FR performances.

The various factors described above are used by our experts and customers alike to offer a suitable solution so as to fulfill the requirements of the standards.

Our lab developed skills and an extrapolation method of Flame Retardants to evaluate the FR performance using UL-94 and LOI tests. Different building standards require different testing methods using the final sheet structure produced by our customers.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>LDR</th>
<th>Standard</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR 01670 PC</td>
<td>Brominated FR</td>
<td>10.0–15.0%</td>
<td>UL-94, 1.6mm, V0.</td>
<td>Transparent</td>
</tr>
<tr>
<td>FR 00 I 17 PC NEW!</td>
<td>Brominated FR Compound</td>
<td>E-84, Class A (Multi Wall Sheet), different thicknesses.</td>
<td>Transparent, solid sheets</td>
<td></td>
</tr>
<tr>
<td>FR 00P90 PC</td>
<td>HFFR</td>
<td>15.0–20.0%</td>
<td>UL-94, 1.6mm, V0.</td>
<td>Transparent, Injection Molding, sheets</td>
</tr>
<tr>
<td>FR 04530 PC</td>
<td>HFFR</td>
<td>2.0–4.0%</td>
<td>UL-94, 1.6mm, V0.</td>
<td>Transparent, Injection Molding, sheets</td>
</tr>
</tbody>
</table>

7. Additive

<table>
<thead>
<tr>
<th>Code</th>
<th>Property</th>
<th>Description</th>
<th>Application</th>
<th>LDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL 00002 PC</td>
<td>Mold Release</td>
<td>Especially for PC injection molding but not only. Solves lubrication problems.</td>
<td>IM</td>
<td>1.0–5.0%</td>
</tr>
<tr>
<td>PA 0080 PC</td>
<td>Processing Aid</td>
<td>Used to eliminate creation of black specs, pigments and additives accumulation on hot, inner parts and to reduce friction and high-shear rates.</td>
<td>Extrusion</td>
<td>~0.5–1.0% start at 2.0% and reduce to minimum after 30 min.</td>
</tr>
<tr>
<td>AB 0G380 PC</td>
<td>Antiblock</td>
<td>Has minimal effect on the product transparency or haze.</td>
<td>PC corrugated</td>
<td>0.3–1.0% in the UV Cap Layer</td>
</tr>
<tr>
<td>AB 0G386 PC</td>
<td>Antiblock – improved optics</td>
<td>Has minimal effect on the product transparency or haze.</td>
<td>PC corrugated</td>
<td>0.5–1.0% in the UV Cap Layer</td>
</tr>
</tbody>
</table>
9. Colors and Special Effects

9.1 Colors
Kafrit specializes in PC and PMMA color matching and can match your color according to MB sample or product sample. It is also possible to perform a match according to RAL or Pantone, in such case it might be less accurate.

Kafrit offers a wide selection of PC and PMMA colors; a catalogue with standard color samples is available upon request.

• Transparent colors
• Opaque colors
• Opal/diffusing colors

9.2 Special Effects

Pearlescent Effect:
Kafrit developed a special technology for pearlescent MB and compound production.

Metallic Effects:
Based on aluminum pigments are often combined with different shades of pigments in order to reach the requested color (metallic green, for example).

Pearlescent and metallic effect colors can be applied easily as a masterbatch in the bulk. The best performance is achieved, when such color masterbatches are applied into a thin, extruded layer underneath the outer top UV-cap layer, which of course requires double extrusion technology. Kafrit offers a variety of pearlescent and metallic colors and can supply a special effect color catalogue with sample chips upon request.

Global supply, local partnership:
We are where you are.

Kafrit
Kafrit Industries (1993) Ltd.
Kibbutz Kfar-Aza,
M.P. Negev, 8514200, Israel
Tel: +972 8 6898445 | Fax: +972 8 6898446
kafrit@kafrit.co.il | www.kafrit.com

CONSTAB
CONSTAB Polyolefin Additives GmbH
Industriestrasse Möhnetal 16
59602 Rüthen, Germany
Tel: +49 2952 8190 | Fax: +49 2952 3140
info@constab.com | www.constab.com

SUZHOU CONSTAB
Suzhou Constab Engineering Plastics Co., LTD
Suzhou Constab Engineering Plastics Co., Ltd.
No. 85 Liaobang Road, Tongji Town, Wujiang District, Suzhou, Jiangsu 215217, China.
Tel: +86 512 6333 1654 | Fax: +86 512 6333987
info@constab.cn | www.constab.cn

Kafrit NA Ltd.
Kafrit NA Ltd.
5411-275th Street, Langley
British Columbia, Canada, V4W 3K8
Tel: +604 607 6730 | Fax: +604 607 6736
management@kafrit.ca | www.kafrit.ca

POLYFIL
Polyfill Incorporated
74 Green Pond Road, P.O. Box 130
Rockaway, NJ 07866, USA
Tel: 973-627-4070 | Fax: 973-627-7344
info@polyfilinc.com | www.polyfilinc.com

Giving Life to Plastic

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Please request for further information:

- **Optimizing BOPP film production**
  with CONSTAB Masterbatches and Compounds

- **BOPE – Sustainable solutions for flexible packaging films**
  with CONSTAB® CON-X Masterbatches

- **Polyethylene Packaging · Polypropylene Cast and Calender Films**
  Rolling to success with Kafrit Group Masterbatches and Compounds

- **Ecocell® – Lighten up!**
  A revolutionary foaming agent to reduce material and resin consumption

- **Agricultural Film**
  Growing success with Kafrit Group Masterbatches and Compounds

- **Pipes and Sheets**
  Customized solutions with Kafrit Group Masterbatches and Compounds

- **Kafrit Group Antioxidants**
  Reliable protection for your plastic products

- **Injection Molding · Blow Molding**
  Injecting new ideas into your products with Kafrit Group Masterbatches and Compounds

- **Strong protection, easy peeling**
  with CONSTAB CONPEEL® Compounds

- **Adding value to Fibers and Nonwovens**
  with Kafrit Group Masterbatches

- **Packaging your needs**
  PET Masterbatches and Compounds

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