Getting a Grip with Better Hot Melts
New polymers add muscle to hot melts

Gripping power. Bond strength. Sealing efficiency. In the world of hot melts, those are the keys to success. Hot melt adhesives (HMAs) have been around for a long time and have provided reliable sealing and bonding solutions for a number of applications. Now, those hot melts can be made even better with innovative new polymers. AFFINITY™ GA Polyolefin Plastomers (POPs) from Dow, will provide performance and processing advantages that can result in exceptional opportunities for formulators and end users alike to capture excellent value compared to current hot melt formulations.

AFFINITY GA POPs, manufactured using INSITE™ Technology from Dow, deliver innovation that will help you create truly differentiated products and end-use applications. Designed to provide superior bond strength over a wide temperature range (Figure 1), AFFINITY GA POPs produce clean-running, clear hot melts for a variety of important applications. AFFINITY GA POPs combine impressive performance results with demonstrated cost savings. In addition, the material’s low density and viscosity enable better processability and cosmetic appearance, as well as aggressive bonding—across a wide array of substrates—that is imperative to robust hot melt formulations and end-user application success.

Figure 1: Service temperature range (°F) for a HMA containing AFFINITY GA POPs vs. incumbent technology

HMA containing AFFINITY GA POPs

EVA Technology

HMAs formulated with AFFINITY GA POPs exhibit exceptional performance at both ends of the temperature scale. This provides value for formulators and end users, as one HMA can solve the low-temperature and high-temperature needs of the HMA consumer. AFFINITY GA POPs are the ideal choice when packaging needs call for freezer-to-microwave exposure, or for applications that must tolerate a wide range of temperatures. For example, testing has indicated peel adhesion failure temperature (PAFT) values as high as 169°F, ensuring reduced seal failure rates and expenses associated with carton/box returns.

Typical HMA applications

Case and carton sealing
• Folding carton sealing
• Corrugated container closure
• Tray forming
• Pallet stabilization
• Line adhesive

General packaging
• Bottle labeling
• Roll feed
• Magazine feed

Graphic arts
• Lay-flat
• Hard cover
• Soft cover

Multi-wall and specialty bag
• Film laminating
• Pinch bottom
• Spot paste
• Valve assembly
• Longitudinal seam and bottom paste
• Plastic bags
• Vacuum bags
• Security bags
• Wax bags

Nonwoven hygenics
• Diaper construction
• Core stabilization

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Performance creates the strongest bond

Dow is driven to enable our customers’ success by offering materials, technology, and service that cover the extremes and everything in between. And, helping our customers choose the right ingredients to produce a superior end result is a great place to start.

For example, HMAs containing AFFINITY™ GA POPs can provide a wide range of performance benefits depending on the tackifier chosen (Table 1). In testing against incumbent HMAs, results indicate that HMAs formulated with AFFINITY GA POPs deliver outstanding heat resistance, fiber tear, and PAFT performance.

AFFINITY GA POPs are available as free-flowing pellets in 25 Kg bags. Bulk quantities may also be available. Partially and fully hydrogenated C5 and C9 resins are compatible with AFFINITY GA POPs. Isothermal compatibility curves for tackifier selection are available. Please contact Dow to obtain a copy.

Data courtesy of Eastman Chemical Company. Information represents North American-grade tackifiers. Equivalent grades are available in other geographies.

Table 1: Conventional application temperature (350°F) HMA
HMA formulations using AFFINITY GA POPs 1950 and three different tackifiers

<table>
<thead>
<tr>
<th>Component, wt%</th>
<th>EASTOTAC H-130R</th>
<th>EASTOTAC H-142R</th>
<th>Experimental Tackifier Resin</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFFINITY GA 1950</td>
<td>34.5</td>
<td>34.5</td>
<td>34.5</td>
</tr>
<tr>
<td>EASTOTAC H-130R</td>
<td>35.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EASTOTAC H-142R</td>
<td></td>
<td>35.0</td>
<td></td>
</tr>
<tr>
<td>MBG 285</td>
<td></td>
<td></td>
<td>40.0</td>
</tr>
<tr>
<td>Paraffin H2</td>
<td>30.0</td>
<td>30.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Irganox 1010</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Formulation performance results

<table>
<thead>
<tr>
<th>Component, wt%</th>
<th>EASTOTAC H-130R</th>
<th>EASTOTAC H-142R</th>
<th>Experimental Tackifier Resin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. PAFT, (°F)</td>
<td>158</td>
<td>169</td>
<td>150</td>
</tr>
<tr>
<td>Avg. SAFT, (°F)</td>
<td>208</td>
<td>204</td>
<td>210</td>
</tr>
<tr>
<td>Avg. Heat Stress, (°F)</td>
<td>200</td>
<td>196</td>
<td>202</td>
</tr>
<tr>
<td>Full Fiber Tear, (°F)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Full Fiber Tear, (°F) Virgin Corrugated</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Full Fiber Tear, (°F) Fiber Tear Recycle</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2: Low application temperature (250°F) HMA
HMA formulations using AFFINITY GA POPs 1900 and three different tackifiers

<table>
<thead>
<tr>
<th>Component, wt%</th>
<th>EASTOTAC H-130R</th>
<th>EASTOTAC H-142R</th>
<th>Experimental Tackifier Resin</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFFINITY GA 1900</td>
<td>29.5</td>
<td>29.5</td>
<td>29.5</td>
</tr>
<tr>
<td>EASTOTAC H-130R</td>
<td>35.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EASTOTAC H-142R</td>
<td></td>
<td>35.0</td>
<td></td>
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<td>Paraffin H2</td>
<td>35.0</td>
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<td>35.0</td>
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<tr>
<td>Irganox 1010</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Formulation performance results vs. Commercial LATHMA

<table>
<thead>
<tr>
<th>Component</th>
<th>EASTOTAC H-130R</th>
<th>EASTOTAC H-142R</th>
<th>MGB 285</th>
<th>Commercial LATHMA†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. PAFT, (°F)</td>
<td>161</td>
<td>169</td>
<td>151</td>
<td>132</td>
</tr>
<tr>
<td>Avg. SAFT, (°F)</td>
<td>188</td>
<td>204</td>
<td>198</td>
<td>165</td>
</tr>
<tr>
<td>Avg. Heat Stress, (°F)</td>
<td>177</td>
<td>196</td>
<td>188</td>
<td>187</td>
</tr>
<tr>
<td>Full Fiber Tear, (°F)</td>
<td>10-15</td>
<td>20</td>
<td>20</td>
<td>&gt;35</td>
</tr>
<tr>
<td>Full Fiber Tear, (°F) Virgin Corrugated</td>
<td>10-15</td>
<td>20</td>
<td>20</td>
<td>&gt;35</td>
</tr>
<tr>
<td>Full Fiber Tear, (°F) Fiber Tear Recycle</td>
<td>10-15</td>
<td>20</td>
<td>20</td>
<td>&gt;35</td>
</tr>
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</table>

†Low application temperature HMA

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Cost efficiencies gained by performance advantages

AFFINITY™ GA POPs enable the development of differentiated HMA formulations with advanced processing and economic performance (Table 2). Cost efficiencies are gained through performance advantages including:

- Increased yield per pound
- Reduced gel and char formation
- Virtually no stringing or spider webbing
- Improved thermal stability
- Wide service temperature range
- Bonding of a wide range of substrates
- Nearly 100-percent fiber tear at both high and low temperatures and on a variety of substrates, including hard-to-bond paper stock
- Improved color and clarity
- Clean machining
- Virtually odor-free

AFFINITY GA POPs provide high mileage due to the lower density that allows for increased yield per pound coupled with aggressive bonding. Formulations containing AFFINITY GA POPs also run clean and char-free, resulting in savings in maintenance expenses, such as cleaning or replacing filters and nozzles. As a result, end users experience much lower rates of line shutdown and lost production. Additionally, the ease of cleaning the spilled or misfired beads from machinery and the lack of angel hairing or spider webs result in more savings in terms of reduced labor costs.

Decreased wear and tear on the equipment, primarily due to lack of acidic groups in the base polymer compared to incumbent polymers, has been documented. The clarity of AFFINITY GA POPs, and the much improved heat stability, offer better color and increased intervals between product changes in the melt tank. Finally, the lack of odor and smoke from the product improves workplace conditions.


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Table 2: Potential economic savings with HMAs containing AFFINITY GA POPs

<table>
<thead>
<tr>
<th>15-25% “mileage” advantage</th>
<th>5-10% additional cost savings</th>
<th>20-35% overall cost savings vs. incumbent formulations</th>
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<tbody>
<tr>
<td>• Product density allows more sealed boxes per pound of adhesive</td>
<td>• Thermal stability means better pot life for less waste</td>
<td>• Trademark of The Dow Chemical Company (“Dow”) or an affiliated company of Dow</td>
</tr>
<tr>
<td>• Aggressive bonding characteristics allow for less adhesive used per application</td>
<td>• Wide service temperature range enables one HMA to do the work of many</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reduced downtime and maintenance time as nozzles and lines require less frequent cleaning and changing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Adherence to a wide range of substrates means reduced carrying costs and inventory</td>
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Understanding what’s important

At Dow, we know that listening to the voice of the customer is imperative to our business growth and key to ensuring our customers’ success. Through continuous R&D investment and technology improvements based on our material science expertise and customer input, we are able to provide product solutions that not only fill an industry need, but also, in some instances, far outpace incumbent technologies.

AFFINITY™ GA POPs do just that. Aggressive adhesion of difficult-to-bond substrates over a wide temperature range (Figure 2) allows HMAs formulated with AFFINITY to become the premier adhesives of the hot melt industry. To end users in case and carton sealing, multi-wall structure fabrication, and nonwoven construction, this aggressive adhesion attribute is vital.

For food-related applications, AFFINITY GA POPs have obtained regulatory approval according to FDA standard 21CFR 175.105 for North America. For current food contact compliance status in Europe, customers should contact a Dow sales representative.

Figure 2: Percent fiber tear at five different temperatures of HMAs formulated with different base polymers

HMAs formulated with AFFINITY GA POPs adhere over a wide temperature range. It takes several different EVA formulations to cover the temperature range of one HMA containing AFFINITY GA POPs.
Anticipating customer needs

Providing material solutions that exceed our customers’ expectations helps Dow stand by its commitment to cover the extremes and everything in between. With AFFINITY™ GA POPs, we are able to realize that vision with features and benefits that not only impact economic value but appeal to aesthetic value and workplace efficiency as well.

For instance, HMAs formulated with AFFINITY GA POPs exhibit exceptional viscosity stability at the application temperature (Figure 3). When formulated with hydrocarbon tackifiers and waxes, the resulting blend is very resistant to oxidation and crosslinking. In addition, formulations containing AFFINITY produce exceptionally clear (Figure 4) and virtually odor-free HMAs. Combined, these properties make HMAs formulated with AFFINITY preferred products when improvement in cosmetic aspects and work environment conditions are desired.

**Figure 3:** Viscosity stability of AFFINITY GA POPs and an EVA-based HMA at 350°F for up to 168 hours

AFFINITY GA POPs help produce HMAs that exhibit exceptional viscosity stability at the application temperature. This outstanding viscosity and color stability allows for clean-running systems without the need to change the HMA in the tank, thus reducing overall cost.

**Figure 4:** Color change at 350°F (177°C) for 148 Hours

HMA formulated with AFFINITY GA POPs - hours at 350°F (177°C)

HMA formulated with EVA technology - hours at 350°F (177°C)
Our commitment to the HMA industry

Dow offers a wide range of technical services to meet the challenges faced by HMA formulators and end users. Our technical service and development (TS&D) experts can provide fast, accurate resolution to issues regarding material science and selection, processing and application development. Our commitment is to support your business as if it were our own, so we’ve established in-house capabilities that include:

- Material science expertise
- Physical and mechanical property testing
- Processing consulting
- Application development services
- Specialized training for sales and technical personnel
- Operator training
- Safety audits
- Industrial hygiene recommendations
- Assistance with FDA, environmental, and other regulatory compliance

Dow also supports our customers with a commitment to the Six Sigma quality discipline. The primary goal of Six Sigma is to achieve excellence by reducing defects in processes, products, and services. The results are significantly higher quality, increased customer satisfaction and loyalty, and improved return on investment.

Our decades of experience, with continual reinvestment in improved products and services, allow our customers to expect on-time delivery of consistent, quality materials that help ensure smoother production runs with fewer defects. Continuous plant maintenance and process improvements driven by Six Sigma methodology make us the supplier our customers can count on to help increase quality and efficiency.

Dow is on a quest to be the best, and to be our customers’ preferred plastic resin and additive supplier for HMAs. To learn more about how working with Dow can benefit your business contact your Dow sales or TS&D representative, or visit www.betterhotmelts.com.

Dow keeps the HMA industry covered with additional product families for special-need applications. The AMPLIFY™ EA Functional Polymer, AMPLIFY GR Functional Polymer, and PRIMACOR™ Copolymer families of Dow polymers offer excellent adhesion on metallic and polar surfaces. Additionally, they can be used in other adhesive-related applications such as batch inclusion coatings and oil-resistant formulations. Visit www.dow.com or contact your Dow sales representative to obtain additional information regarding AMPLIFY Functional Polymers or PRIMACOR Copolymers.
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b. Use in cardiac prosthetic devices regardless of the length of time involved; (“cardiac prosthetic devices” include, but are not limited to, pacemaker leads and devices, artificial hearts, heart valves, intra-aortic balloons and control systems, and ventricular bypass-assisted devices);

c. Use as a critical component in medical devices that support or sustain human life; or

d. Use specifically by pregnant women or in applications designed specifically to promote or interfere with human reproduction.

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