AFFINITY™ GA Polyolefin Elastomers (POEs) offer performance, processability, and value for a range of hot melt adhesives (HMAs) that are sometimes difficult to achieve with traditional HMA formulations. Combining powerful adhesion with a host of other attributes, AFFINITY™ GA POEs offer opportunities to create formulations that meet and potentially exceed the requirements of HMA applications.

AFFINITY™ GA 1000R POE is an innovative solution that addresses growing demand across the value chain for hot melt adhesives (HMAs) with excellent adhesion to hard-to-bond substrates.

Creating stronger bonds

As a maleic anhydride (MAH) grafted polymer, AFFINITY™ GA 1000R accentuates the excellent adhesive properties inherent in all AFFINITY™ GA resins. This allows HMAs formulated with AFFINITY™ GA 1000R to take on some of the most difficult bonding challenges faced by adhesive formulators, packaging manufacturers, and brand owners:

• Low surface energy substrates, such as polyethylene (PE) or polypropylene (PP)
• Low porosity or low surface roughness substrates, such as paper or cardboard that’s coated for functionality or aesthetics
• Substrates with short fiber length due to high content of recycled material

Testing was conducted to compare the bonding of HMAs produced with AFFINITY™ GA 1000R with that of HMAs based on an Ethylene-Vinyl Acetate (EVA) and AFFINITY™ GA 1900. To help ensure the validity of the tests, the following hard-to-bond substrates were selected:

• Beverage packaging substrate from China
• Coated non-printed cardboard from South Africa

Figures 1 and 2 show significantly increased fiber tear for both substrates across a range of temperatures as the AFFINITY™ GA 1000R content increases.

Typical HMA applications:
• Case and carton sealing
• General packaging
• Graphic arts
• Multi-wall and specialty bags

Table 1: Typical Properties of Selected AFFINITY™ GA POEs

<table>
<thead>
<tr>
<th>Polymer</th>
<th>AFFINITY™ GA 1000R POE</th>
<th>AFFINITY™ GA 1900 POE</th>
<th>AFFINITY™ GA 1950 POE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density g/cm³</td>
<td>0.878</td>
<td>0.870</td>
<td>0.874</td>
</tr>
<tr>
<td>Brookfield Viscosity @ 177°C (350°F), cps</td>
<td>13,000</td>
<td>8,200</td>
<td>17,000</td>
</tr>
<tr>
<td>Approximate Melt Index, g/10 min (190°C, 2.16 kg weight)</td>
<td>660</td>
<td>1,000</td>
<td>500</td>
</tr>
<tr>
<td>DSC Melting Point, °C/°F</td>
<td>68 / 154</td>
<td>68 / 154</td>
<td>70 / 158</td>
</tr>
<tr>
<td>Crystallinity, %</td>
<td>20</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>Glass Transition Temperature, °C/°F</td>
<td>-58 / -72</td>
<td>-58 / -72</td>
<td>-57 / -71</td>
</tr>
</tbody>
</table>

(1) Data per tests conducted by Dow. Test protocols and additional information available upon request. Properties shown are typical, not to be construed as specifications.
(2) Value is approximate; points are outside normal testing range.
(3) Dow Method. Test protocols and additional information available upon request.

Figure 1: Percent Fiber Tear of Beverage Packaging Substrate Using HMAs Formulated with Selected Base Polymers at Various Temperatures

Figure 2: Percent Fiber Tear of Coated Non-printed Cardboard Using HMAs Formulated with Selected Base Polymers at Various Temperatures
Increased formulation flexibility

No two hard-to-bond substrates are the same and the physical and chemical bonding depends on the nature of the substrate. AFFINITY™ GA 1000R offers formulators the ability to tailor formulations to address the specific characteristics of most HMA applications. In addition to offering an excellent alternative to incumbent materials, AFFINITY™ GA 1000R can be used in various amounts in combination with other AFFINITY™ GA polymers to offer additional performance benefits. AFFINITY™ GA 1000R, however, goes one step further. The resin itself can be tailored to adjust the levels of viscosity, MAH graft, and even cost savings.

Improved heat resistance

In addition to helping promote the adhesive properties of AFFINITY™ GA 1000R, MAH grafting helps to offer between 5 °C (9 °F) - 10 °C (18 °F) greater heat stress during transportation and storage compared to AFFINITY™ GA 1900 alone. Table 2 shows the results of testing on coated, non-printed cardboard where the highest heat resistance can be achieved with 30 wt% and 40 wt% of AFFINITY™ GA 1000R in the formulation (formulations F and G), passing the 60 °C (140 °F) heat stress test.

Table 2: Heat Stress Resistance tests of HMA Formulations with Selected Base Polymers at Various Temperatures(1)

<table>
<thead>
<tr>
<th>Heat Stress Resistance(3): Coated Non-printed Cardboard (failure = cohesive)</th>
<th>Formulation(3):</th>
</tr>
</thead>
<tbody>
<tr>
<td>122°F (50 °C)</td>
<td>40 wt% AFFINITY™ GA 1900</td>
</tr>
<tr>
<td>131°F (55 °C)</td>
<td>10 wt% AFFINITY™ GA 1000R</td>
</tr>
<tr>
<td>140°F (60 °C)</td>
<td>30 wt% AFFINITY™ GA 1000R</td>
</tr>
</tbody>
</table>

(1) Data per tests conducted by Dow. Test protocols and additional information available upon request. Properties shown are typical, not to be construed as specifications.
(2) Basic Formulation: 40 wt% Polymer, 34.5 wt% Tackifier, 25 wt% Wax, 0.5 wt% Anti-oxidant
(3) Heat stress resistance is measured according to the “Suggested Test Method for Determining the Heat Stress Resistance of Hot Melt Adhesives”, method T-3006, prepared by the Institute of Packaging Professions (IoPP).

Let’s stick together

Dow Elastomers is dedicated to offering excellent performance and value through materials, technology, and service aimed at addressing the specific needs of our customers. The addition of AFFINITY™ GA 1000R POE to the highly respected line of AFFINITY™ GA Polyolefin Elastomers (POEs) gives HMA formulators one more reason to choose Dow for performance, processing, and end-use advantages not previously achievable with some EVA formulations.

Other AFFINITY™ GA Polyolefin Elastomer (POE) grades that can be used in conjunction with AFFINITY™ GA 1000R POE are:

- **AFFINITY™ GA 1875 POE** – Designed for low application temperature hot melt adhesives (LATHMA) of 120°C or below
- **AFFINITY™ GA 1900 POE** – Designed for LATHMAs ranging from 135 °C - 150 °C (275 - 302 °F)
- **AFFINITY™ GA 1950 POE** – Designed for standard application temperature HMAs (175 °C [347 °F])
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