New Gel Detection for Dow Solution Polyethylene
A New Technology to Improve Customer Productivity and Product Quality

Consistency. Reliability. Quality. These are the characteristics customers want in the products we deliver. They are also the drivers behind the new gel detection process in the Dow Polyethylene Business – a process using state-of-the-art equipment designed to improve the quality of Solution Process Polyethylene Resins delivered to processing sites around the world.

Gels reduce productivity and can result in an end product far below customer standards. This often means waste, off-lot sales and reduced profits.

Traditional detection methods were sometimes incapable of identifying the gel content of the whole product. We needed to make the detection process more accurate to take the reliability of gel detection to a new level. In an effort to improve customer service, and to maintain consistency with our company-wide Six Sigma goal of virtually zero defects, we committed to improving our gel detection process. We invested $24 million in the newest and most advanced equipment to measure gel content. We changed the sample collection process, as well as how gel content is reported on the Certificate of Analysis (COA). We are excited about the changes and pleased to share the benefits with our customers.

Read on to find out how our improvements in gel detection equipment, processes and reporting can improve productivity and the products Dow customers receive.

The New Technology – Better Quality for Our Valued Customers

The new methods of sample gathering and gel analysis are now in place for 16 trains in eight Dow solution plants globally, improving sample accuracy, gel detection and measurement, and flexibility in the loading process. This means less waste, better shipping times and higher confidence in product consistency and quality.

The new technology includes a process of continuous sampling at the production line, in which a side stream of polyethylene pellets is collected as the product comes off the line. Dow takes 50 samples per hour, each measuring 24.6 cm³ – two to four times more than the old method. Because of this constant sample collection, the film produced from the samples more accurately represents the entire production lot – not just a small “snapshot.”

In addition, if the total gel area of a sample is too high, Dow has the ability to react quickly, diverting product from the prime lot, so customers receive a more consistent, higher quality product.

Improving the sampling process is just the beginning. The way gels are measured on the film line has also been greatly improved. To determine the total gel area, state-of-the-art cameras manufactured by Optical Control Systems (OCS) are used to continuously scan the film line. Gels are measured and digitized to determine the actual size of each, then added together and reported as a total gel area, providing a much more accurate picture of the total gel content of the entire production lot.

Comparison of Gel Detection Results

Another point of distinction for the new method, in addition to detecting and totaling the actual sizes of each gel, is the capability of detecting the very small gels, which is also factored into the total gel area. The old method could not detect the very small gels, therefore the total gel count only included large, medium and small sizes.

The table below shows test results using the old method (gel count) and the new method (gel area).

<table>
<thead>
<tr>
<th>Product</th>
<th>Large</th>
<th>Medium</th>
<th>Small</th>
<th>Very Small</th>
<th>Total Gel Count</th>
<th>Total Gel Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>40</td>
<td>7</td>
<td>23.9</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>50</td>
<td>7</td>
<td>15.0</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>25</td>
<td>7</td>
<td>7.9</td>
</tr>
</tbody>
</table>

Note that it is possible for two or more samples to have the same gel count while having very different gel areas. Products A, B and C would have passed gel count standards and been shipped as prime product. However, only products B and C would be acceptable by gel area standards. Product A, despite having the same gel count as B and C, would be unacceptable and therefore sold as offgrade because of the high gel area.

It is important to keep in mind that these state-of-the-art changes in gel detection may not eliminate all gels. Gels can be formed in the manufacturing of resins, shipping and handling and in final processing equipment.

1 DOWLEX® polyethylene resins, ATTANE® ultra low density polyethylene copolymers, AFFINITY® polyolefin plastomers, ELITE® enhanced polyethylene resins, ASPUN® fiber grade resins
2 A quality discipline throughout Dow that focuses on product and service excellence
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Sample Certificate of Analysis

Certificate 613611  The Dow Chemical Company Page 1
Date: 06/18/2001 Certificate of Analysis Shipped: 06/18/2001

Attention: Customer Name and address

 Cust P.O.: Divy Note: 9876543
Order No.: 1234567

Material: DOWLEX® 2045 POLYETHYLENE RESIN
BULK

 Cust Mtl: PR000134

 Batch: PB24019Z1E

 Divy Qty: LB 175,000
 Vehicle: DOWX022407

Ship from: THE DOW CHEMICAL COMPANY PLAQUEMINE, LA UNITED STATES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Units</th>
<th>Results</th>
<th>Limits</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melt Index, 2.16kg @ 190 degC</td>
<td>g/min</td>
<td>PB24019Z1E</td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>Flow Ratio, I10/I2 @ 190 degC</td>
<td>-</td>
<td>8.2</td>
<td>7.4</td>
<td>8.6 ASTMD1238</td>
</tr>
<tr>
<td>Density</td>
<td>g/cm³</td>
<td>0.9199</td>
<td>0.9180</td>
<td>0.9220 ASTM D792</td>
</tr>
<tr>
<td>Total Gel Area</td>
<td>mm²/24.6 cm³</td>
<td>13</td>
<td>----</td>
<td>20 DOW METHOD</td>
</tr>
</tbody>
</table>

Bill Efaw
Global Polyolefin Business Quality Leader

For inquiries please contact Customer Service or local sales.

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A Change in Reporting – A Change for the Better

Because of the new detection capabilities and the enhanced measurements collected, COAs will no longer show a gel count. Gel data will now be reported as total gel area. For consistency, and to help customers adjust to the new gel data, all of our plants around the world will be using the same gel detection process as well as the same reporting method. So wherever customers purchase Dow Solution Process Polyethylene, our COAs will report gel content as gel area.

Left is a sample COA with the new gel area in mm²/24.6 cm³.

Questions?

Through this initiative and others, we have made a substantial investment in increasing customer satisfaction with Dow Polyethylene products. As always, use of our products is supported by an extensive technical service network. Technical service personnel and laboratories worldwide provide unique opportunities for product support and development, productivity enhancements and more, including:

- Processing seminars for operations personnel.
- Development of system designs and operating procedures to assure fast, accurate production.
- Specialized polyethylene training.
- Blown and cast film laboratory lines to produce, evaluate and scale-up quantities of film.
- Numerous analytical testing capabilities.

For more information about Dow Polyethylene products, use the appropriate number listed on the back page.
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