PARALOID™ EXL-5900 Optical Properties Modifier
For Polycarbonate and Polystyrene

Regional Product Availability
Asia-Pacific

Description
PARALOID™ EXL-5900 is a high efficiency optical properties modifier developed for engineering resins. Its core-shell structure is based on acrylic chemistry. PARALOID EXL-5900 Modifier has a unique particle size and very narrow poly-dispersity which provides efficient light diffusion in transparent matrices such as polycarbonate and polystyrene without impairing mechanical properties of the polymer matrix. PARALOID EXL-5900 Modifier can typically be used in LCD diffusion boards and LED optical systems to compensate for unidirectional lighting. It can also be used for items such as plastic covers on lamps where soft or homogenous lighting is needed.

Physical Properties
Appearance: Free Flow White Powder
Bulk Density: 0.40 ± 0.1g/cc
Volatile matter: <1.0%

Processing
PARALOID™ EXL-5900 Modifier should be compounded on twin screw extruders to achieve optimum dispersion. Using a pre-dispersed, master-batch is recommended for processing on low shear equipment such as single screw extruders. Using a set of high mesh sieves in the extruder is recommended to get an excellent product surface appearance.

Recommended Use Levels
The use level depends on the required optical performance in a particular formulation. Please refer to the tables that follow for guidance or contact your Dow Plastics Additives technical representative for recommendations.

Light Diffusion Performance
PARALOID™ EXL-5900 Modifier in Polystyrene
PARALOID EXL-5900 Modifier is highly efficient at diffusing light in polystyrene formulations. Fluorescent whitening agents can be used with PARALOID EXL-5900 Modifier to control the overall yellow index.

Figure I: Output Intensity versus Viewing Angles of 1% PARALOID™ EXL-5900 Modifier in Polystyrene Resin
Light Diffusion Performance (Continued)

TABLE 1: Optical properties of light diffuser plates (1.5 mm thick), containing 0.5 and 1.0 weight percent of PARALOID™ EXL-5900 Diffuser Beads, evaluated by both Goniophotometer and colorimeter (Hunter Laboratory).

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>a</th>
<th>b</th>
<th>Haze</th>
<th>Diffusivity (%)</th>
<th>Y Total (%)</th>
<th>YI D1925 (%)</th>
<th>Brightness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neat Polystyrene</td>
<td>95.38</td>
<td>-0.16</td>
<td>1.35</td>
<td>1.35</td>
<td>NM</td>
<td>90.98</td>
<td>2.40</td>
<td>89.22</td>
</tr>
<tr>
<td>0.5% PARALOID™ EXL-5900</td>
<td>89.67</td>
<td>0.46</td>
<td>5.53</td>
<td>85.75</td>
<td>11.88</td>
<td>80.41</td>
<td>11.37</td>
<td>73.54</td>
</tr>
<tr>
<td>1% PARALOID EXL-5900</td>
<td>85.25</td>
<td>0.47</td>
<td>4.93</td>
<td>86.48</td>
<td>17.52</td>
<td>72.67</td>
<td>10.72</td>
<td>66.85</td>
</tr>
<tr>
<td>0.5% PARALOID EXL-5900 + 0.005% florescent whitening agent</td>
<td>89.13</td>
<td>1.08</td>
<td>3.48</td>
<td>85.95</td>
<td>13.07</td>
<td>79.45</td>
<td>7.84</td>
<td>75.18</td>
</tr>
<tr>
<td>1% PARALOID EXL-5900 + 0.01% florescent whitening agent</td>
<td>83.64</td>
<td>1.18</td>
<td>1.96</td>
<td>86.56</td>
<td>18.21</td>
<td>69.96</td>
<td>5.19</td>
<td>67.82</td>
</tr>
</tbody>
</table>

TABLE 2: Optical properties of light diffuser plates (2.11 mm thick), containing 0.5 and 1.0 weight percent of PARALOID™ EXL-5900 Diffuser Beads, evaluated by both Goniophotometer and colorimeter (Hunter Laboratory).

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>a</th>
<th>b</th>
<th>Haze</th>
<th>Diffusivity (%)</th>
<th>Y Total (%)</th>
<th>YI D1925 (%)</th>
<th>Brightness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neat Polystyrene</td>
<td>95.07</td>
<td>-0.21</td>
<td>1.76</td>
<td>1.61</td>
<td>NM</td>
<td>90.39</td>
<td>3.14</td>
<td>88.11</td>
</tr>
<tr>
<td>0.5% PARALOID™ EXL-5900</td>
<td>86.23</td>
<td>0.56</td>
<td>5.96</td>
<td>86.25</td>
<td>14.59</td>
<td>74.35</td>
<td>12.80</td>
<td>67.23</td>
</tr>
<tr>
<td>1% PARALOID EXL-5900</td>
<td>81.28</td>
<td>0.24</td>
<td>4.92</td>
<td>86.55</td>
<td>20.24</td>
<td>66.07</td>
<td>11.01</td>
<td>60.56</td>
</tr>
<tr>
<td>0.5% PARALOID EXL-5900 + 0.005% florescent whitening agent</td>
<td>84.32</td>
<td>1.29</td>
<td>3.37</td>
<td>86.45</td>
<td>15.65</td>
<td>71.09</td>
<td>8.24</td>
<td>67.19</td>
</tr>
<tr>
<td>1% PARALOID EXL-5900 + 0.01% florescent whitening agent</td>
<td>79.70</td>
<td>0.82</td>
<td>1.99</td>
<td>86.61</td>
<td>21.18</td>
<td>63.52</td>
<td>5.19</td>
<td>61.55</td>
</tr>
</tbody>
</table>

TABLE 3: Mechanical property evaluation by notched Izod impact, determination at 23 °C (ft.lbs/in.)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Notched Izod Impact (ft.lbs/in)</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neat Polystyrene</td>
<td>0.2</td>
<td>0.03</td>
</tr>
<tr>
<td>0.5% PARALOID™ EXL-5900 Modifier</td>
<td>0.22</td>
<td>0.02</td>
</tr>
<tr>
<td>1% PARALOID EXL-5900</td>
<td>0.21</td>
<td>0.03</td>
</tr>
<tr>
<td>0.5% PARALOID EXL-5900 + 0.005% fluorescent Whitening agent</td>
<td>0.22</td>
<td>0.02</td>
</tr>
<tr>
<td>1% PARALOID EXL-5900 + 0.01% fluorescent Whitening agent</td>
<td>0.2</td>
<td>0.03</td>
</tr>
</tbody>
</table>
PARALOID™ EXL-5900 Modifier is highly efficient at diffusing light without compromising the light transmission in polycarbonate formulations.

**Figure 2: Output Intensity versus Viewing Angles of 0.5% light diffuser in Polycarbonate Resin**

![Figure 2](image)

**Figure 3: Diffusivity vs. loading level of light diffuser**

![Figure 3](image)

**Figure 4: The relationship between total transmission and diffusivity of PARALOID™ EXL-5900 Modifier**

![Figure 4](image)
Handling Precautions

Before using this product, consult the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

CAUTION! Keep combustible and/or flammable products and their vapors away from heat, sparks, flames and other sources of ignition including static discharge. Processing or operating at temperatures near or above product flashpoint may pose a fire hazard. Use appropriate grounding and bonding techniques to manage static discharge hazards.

CAUTION! Failure to maintain proper volume level when using immersion heaters can expose tank and solution to excessive heat resulting in a possible combustion hazard, particularly when plastic tanks are used.

Storage

Store products in tightly closed original containers at temperatures recommended on the product label.

Disposal

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

It is the user’s responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations. Contact your Dow Plastics Additives Technical Representative for more information.

Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products—from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

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