**PRIMAL™ HG-415 Pure Acrylic Binder**

For Gloss Paints With Improved Application Properties

PRIMAL™ HG-415 Acrylic Binder is a pure acrylic gloss enamel binder providing improved application properties (flow and levelling) versus conventional acrylic polymers. PRIMAL™ HG-415 Acrylic Binder uses ambient temperature cross-linking to offer improved film performance versus conventional polymers. It has a high gloss potential, excellent hardness development and durability for interior and exterior applications.

### Regional Product Availability

**Application**

- APEO free *
- Very good applicability, flow and leveling and improved open time
- Very good gloss potential
- Good hardness development and block resistance
- Very good exterior durability
- Excellent alkyd adhesion
- Good stain and grease resistance

*APEO are not intentionally added and are not knowingly introduced from another raw material

### Typical Properties

(The following properties are typical but do not constitute specifications)

<table>
<thead>
<tr>
<th>Property</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Milky white liquid</td>
</tr>
<tr>
<td>Solids Content</td>
<td>44.5–45.5 %</td>
</tr>
<tr>
<td>pH</td>
<td>8.0–9.0</td>
</tr>
<tr>
<td>Brookfield LV Viscosity (Spindle 3, 60 rpm)</td>
<td>&lt;500 mPa.s</td>
</tr>
<tr>
<td>Minimum Film Formation Temperature</td>
<td>~23°C</td>
</tr>
<tr>
<td>Specific gravity (wet polymer)</td>
<td>1.06 g/cm³</td>
</tr>
<tr>
<td>Specific gravity (dry polymer)</td>
<td>1.14 g/cm³</td>
</tr>
</tbody>
</table>

### Formulation Guidelines

**Ambient temperature cross-linking technology**

PRIMAL™ HG-415 Acrylic Binder uses ambient temperature cross-linking chemistry in a one-pack system. Gloss paints formulated with PRIMAL™ HG-415 Acrylic Binder will oxidatively cure during and after the latex particles have coalesced to form a film with improved toughness and resistance properties. The binder develops good early film properties, which improve during the curing process. The inherent improved wet edge and reflow properties of PRIMAL™ HG-415 Acrylic Binder lead to enhanced dry film appearance with optimized film build, edge coverage, flow and leveling. Formaldehyde or aldehyde releasing additives will adversely affect the performance of paints based on PRIMAL™ HG-415 Acrylic Binder and are not recommended.
Below are some guidelines to help formulators:

**Dispersants**
Hydrophobic copolymers like OROTAN™ 731-A ER Dispersant or hydrophilic copolymers like OROTAN™ 1124 Dispersant can be used with this self-cross-linking binder. Both give good gloss development and pigment stability upon aging of the paint.

**Defoamers**
A combination of DOWSIL™ 8603 Additive in the grind and DOWSIL™ 8590 Additive in the let-down was found to give good performance in gloss formulations based on PRIMAL™ HG-415 Acrylic Binder. The optimal combination of defoamers in a semi-gloss paint based on PRIMAL™ HG-415 was found to be DOWSIL™ 74 Additive in the grind and DOWSIL™ 62 Additive in the let-down.

**Rheology Modifiers and Thickeners**
PRIMAL™ HG-415 Acrylic Binder used in combination with appropriate rheology modifiers facilitates reaching an alkyd like flow behaviour. The "low shear" / "high shear" viscosity balance profile, which can be obtained from PRIMAL™ HG-415 Acrylic Binder, is much more Newtonian than most commercial waterborne technologies. HEUR type thickeners are suggested to maximize flow and gloss properties of paints based on PRIMAL™ HG-415 Acrylic Binder. ACRYSOL™ RM-3030 and ACRYSOL™ RM-2020E Rheology Modifiers have been found to offer a distinctive Newtonian rheological profile to gloss and semi-gloss paints based on PRIMAL HG-415 Acrylic Binder. This distinctive profile helps the paint formulator to get high "high shear" viscosity (Cone and Plate viscosity) while maintaining a relatively low "low shear" viscosity. This permits to optimize film build, brush drag (closer to that of conventional solvent based alkyd paints) and maintain the flow characteristics. If higher low shear viscosity is required, addition of ACRYSOL™ RM-8WE or ACRYSOL™ SCT-275 Rheology Modifiers can be done without affecting flow and application performance.

**Coalescents and co-solvents**
We suggest starting with a coalescent level in the range of 8–10% calculated on binder solids. In our studies, we found that an 8% level of DOWANOL™ DPhnB Glycol Ether, Texanol or UCAR™ Flimer IBT ester alcohol is suitable to get a good film formation. The excellent flow and reflow properties of PRIMAL™ HG-415 Acrylic Binder can be achieved without the use of a co-solvent such as propylene glycol or other open time improver. Therefore, PRIMAL™ HG-415 Acrylic Binder can be used to formulate very low VOC gloss and semi-gloss paints.

**Extenders and opaque polymer**
PRIMAL™ HG-415 Acrylic Binder has been developed for the formulation of gloss and semi-gloss paints. In semi-gloss formulations, any standard extenders, e.g. calcium carbonate, clays, can be used. The use of ROPAQUE™ Ultra E Organic Opacifier can help reduce the amount of titanium dioxide, thus formulation cost without affecting dry film appearance and resistance characteristics. Like with conventional binders, the advantages of ROPAQUE™ Ultra E in terms of durability and dirt pick up resistance are noticeable.

**Biocides**
Although standard in can preservatives could be used in paint formulations, it is always recommended to test them for compatibility and efficacy. As in can preservatives, we suggest the use of ROCIMA™ MB2X Biocide.
For exterior coatings, it is suggested to use a film preservative like BIOBAN™ 350 PST Biocide. Formaldehyde or aldehyde releasing additives are not suggested when formulating paints with PRIMAL™ HG-415 Acrylic Binder. They can interact with the self-cross-linking mechanism present in the binder and adversely affect the performance of paints.
Interior / Exterior Gloss Formulation based on
PRIMAL™ HG-415 Acrylic Binder with UCAR™ Filmer
IBT Coalescent Solvent (PVC 17%)
G-415-17-01

<table>
<thead>
<tr>
<th>Materials</th>
<th>Kilograms</th>
<th>Liters</th>
<th>PVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grind</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>40.0</td>
<td>40.0</td>
<td></td>
</tr>
<tr>
<td>OROTAN™ 731A ER Dispersant</td>
<td>8.0</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>DOWSIL™ 8603 Additive</td>
<td>2.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>ACRYSOL™ RM-3030 Rheology Modifier</td>
<td>8.0</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>Ti-Pure R-706 Titanium dioxide</td>
<td>200.0</td>
<td>50.0</td>
<td>17.3%</td>
</tr>
<tr>
<td>Grind Sub-total</td>
<td>258.0</td>
<td>106.9</td>
<td></td>
</tr>
</tbody>
</table>

Let Down

Add the grind to:

PRIMAL™ HG-415 Acrylic Binder     607.0    572.1
DOWSIL™ 8590 Additive             1.0      1.0
Water                              50.0     50.0

Then add slowly:

UCAR™ Filmer IBT Coalescent Solvent 21.9    23.1
ACRYSOL™ RM-3030 Rheology Modifier 22.2    21.3
ACRYSOL™ RM-8WE Rheology Modifier  1.4      1.3
Water                              30.5     30.5
ROCIMA™ MB2X Biocide               1.0      0.9
BIOBAN™ 350 PST Biocide            7.0      6.4

Totals                              1000.0   813.5   17.3%

Paint Properties

Volume Solids: 37%
Weight Solids: 49%
Density: 1.230
pH: ~8.6
Dispersant (active based on total powders): 1.0%
Coalescent (based on polymer solids): 8.0%
Calculated VOC* content (g/L of wet paint): 0

(*) VOC: Amount in g/L of organic compounds having an initial boiling point less than or equal to 250°C measured at a standard pressure of 101.3 kPa.

Viscosities:

Krebs Stormer (KU): 95–105
ICI Cone & Plate (Poise): 2.1–2.5
Brookfield (spindle 4 / 30 rpm) (mPa.s): 3800–4500
Brookfield (spindle 4 / 60 rpm) (mPa.s): 3000–3500

Gloss (100 µm, on glass), %:
Gloss 20° / 60°: ~60 / ~82

Block resistance (100 µm, N/cm²):
1 day / 7 days dry: 5 (average) / 0 (excellent)

König hardness (100 µm, on glass), sec:
1 day: ~36
7 days: ~43
1 month: ~58
Interior / Exterior Gloss Formulation based on PRIMAL™ HG-415 Acrylic Binder with DOWANOL™ DPnB Glycol Ether (PVC 17%)

G-415-17-02

<table>
<thead>
<tr>
<th>Materials</th>
<th>Kilograms</th>
<th>Liters</th>
<th>PVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grind</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>40.0</td>
<td>40.0</td>
<td></td>
</tr>
<tr>
<td>OROTAN™ 731A ER Dispersant</td>
<td>8.0</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>DOWSIL™ 8603 Additive</td>
<td>2.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>ACRYSOL™ RM-3030 Rheology Modifier</td>
<td>8.0</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>Ti-Pure R-706 titanium dioxide</td>
<td>200.0</td>
<td>50.0</td>
<td>17.3%</td>
</tr>
<tr>
<td>Grind Sub-total</td>
<td>258.0</td>
<td>106.9</td>
<td></td>
</tr>
</tbody>
</table>

Let Down

Add the grind to:

| PRIMAL™ HG-415 Acrylic Binder          | 604.0     | 569.3  |     |
| DOWSIL™ 8590 Additive                 | 1.0       | 1.0    |     |
| Water                                  | 30.0      | 30.0   |     |

Add as a premix:

| DOWANOL™ DPnB Glycol Ether             | 21.8      | 23.8   |     |
| Water                                  | 21.3      | 21.3   |     |

Then add slowly:

| ACRYSOL™ RM-3030 Rheology Modifier     | 35.1      | 33.7   |     |
| ACRYSOL™ RM-8WE Rheology Modifier      | 3.0       | 2.9    |     |
| Water                                  | 17.8      | 17.8   |     |
| ROCIMA™ MB2X Biocide                    | 1.0       | 0.9    |     |
| BIOBAN™ 350 PST Biocide                | 7.0       | 6.4    |     |

Totals                                   | 1000.0    | 814.0  | 17.3% |

Paint Properties

Volume Solids: 37%
Weight Solids: 49%
Density: 1.230
pH: ~8.6
Dispersant (active based on total powders): 1.0%
Coalescent (based on polymer solids): 8.0%
Calculated VOC* content (g/L of wet paint): 27

(*) VOC: Amount in g/L of organic compounds having an initial boiling point less than or equal to 250°C measured at a standard pressure of 101.3 kPa.

Viscosities:

Krebs Stormer (KU): 95-105
ICI Cone & Plate (Poise): 2.1–2.5
Brookfield (spindle 4/30 rpm) (mPa.s): 2800–3400
Brookfield (spindle 4/60 rpm) (mPa.s): 2300–2900

Film Properties

Gloss (100 µm, on glass), %:
Gloss 20°/60°: ~60 / ~81

Block resistance (100 µm, N/cm²):
1 day / 7 days dry: 2.5 (good) / 0 (excellent)

König hardness (100 µm, on glass), sec:
1 day: ~42
7 days: ~65
1 month: ~66
Interior / Exterior Semi-Gloss Formulation based on PRIMAL™ HG-415 Acrylic Binder with UCAR™ Filmer IBT Coalescent Solvent (PVC 35%)

SG-415-35-01

<table>
<thead>
<tr>
<th>Materials</th>
<th>Kilograms</th>
<th>Liters</th>
<th>PVC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grind</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>70.00</td>
<td>70.00</td>
<td></td>
</tr>
<tr>
<td>OROTAN™ 731AER Dispersant</td>
<td>9.43</td>
<td>8.48</td>
<td></td>
</tr>
<tr>
<td>DOWSIL™ 74 Additive</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>ACRYSOL™ RM-3030 Rheology Modifier</td>
<td>4.00</td>
<td>3.80</td>
<td></td>
</tr>
<tr>
<td>Ti-Pure R-706 titanium dioxide</td>
<td>180.00</td>
<td>45.00</td>
<td>16.0%</td>
</tr>
<tr>
<td>Omyacoat 850 OG</td>
<td>53.00</td>
<td>19.60</td>
<td>7.0%</td>
</tr>
<tr>
<td><strong>Grind Sub-total</strong></td>
<td>317.43</td>
<td>147.88</td>
<td></td>
</tr>
</tbody>
</table>

| **Let Down**                     |           |        |     |
| Add the grind to:                |           |        |     |
| PRIMAL™ HG-415 Acrylic Binder    | 460.00    | 433.60 |     |
| ROPAQUE™ Ultra E Organic Opacifier | 68.00 | 66.30 | 12.3%|
| Water                            | 49.8      | 49.8   |     |
| DOWSIL™ 62 Additive              | 1.00      | 1.00   |     |
| UCAR™ Filmer IBT Coalescent Solvent | 16.50 | 17.40 |     |
| ACRYSOL™ RM-3030 Rheology Modifier | 46.24 | 43.93 |     |
| Water                            | 33.03     | 33.03  |     |
| ROCIMA™ MB2X Biocide              | 1.00      | 0.90   |     |
| BIOBAN™ 350 PST Biocide           | 7.00      | 6.40   |     |
| **Totals**                       | 1000.00   | 800.24 | 35.3%|

**Paint Properties**

- **Volume Solids:** 36%
- **Weight Solids:** 47%
- **Density:** 1.250
- **pH:** ~8.6
- **Dispersant (active based on total powders):** 1.0%
- **Coalescent (based on polymer solids):** 7.2%
- **Calculated VOC* content (g/L of wet paint):** 0

(*) VOC: Amount in g/L of organic compounds having an initial boiling point less than or equal to 250°C measured at a standard pressure of 101.3 kPa

**Viscosities:**

- **Krebs Stormer (KU):** 94-98
- **ICI Cone & Plate (Poise):** 2.8-3.2
- **Brookfield (spindle 4/30 rpm) (mPa.s):** 2600–3000
- **Brookfield (spindle 4/60 rpm) (mPa.s):** 2000–2500

**Film Properties**

**Gloss (100 µm, on glass), %:**
- **Gloss 20° / 60°:** 33–35

**Block resistance (100 µm, N/cm²):**
- **1 day:** 0 (excellent)

**König hardness (100 µm, on glass), sec:**
- **1 day:** ~52
- **7 days:** ~63
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.

Storage

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

Disposal Considerations

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 Coating Materials Technical Representative for more information.

Chemical Registration

Many countries within EMEA require the registration of chemicals, either imported or produced locally, prior to their commercial use. Violation of these regulations may lead to substantial penalties imposed upon the user, the importer or manufacturer, and/or cessation of supply. It is in your interests to ensure that all chemicals used by you are registered. The Dow Chemical Company does not supply unregistered products unless permitted under limited sampling procedures as a precursor to registration.

Note on EMEA Product Line

Product availability and grades vary throughout the countries in the EMEA area. Please contact your local Dow Coating Materials representative for further information and samples.

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.

Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

For more information visit our website: www.coatings.dow.com

To contact us, call:
Europe, Middle East & Africa: +31 115 672 626
India: +60 3 7965 5392
Or visit our page: http://coatings.dow.com/en/contact-us

Notice: No freedom from any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other government enactments. The product shown in this literature may not be available for sale and/or available in all geographies where Dow is represented. The claims made may not have been approved for use in all countries. Dow assumes no obligation or liability for the information in this document. References to “Dow” or the “Company” mean the Dow legal entity selling the products to Customer unless otherwise expressly noted. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.