Charmor® PM40 and PM15 for intumescent paints

General
Interest in intumescent paints has grown rapidly in recent years due to increased demand from insurance companies and legislation. Water-borne versions are growing in importance for environmental reasons. Intumescent paints prolong the time in which people are able to evacuate public places such as houses, airports, hospitals and sports arenas. They can also limit the structural damage to properties when fire breaks out. At very high temperatures, around 550 °C, steel sections become distorted and lose their mechanical strength, which could lead to a collapse of the construction.

Many of the components in an intumescent paint have an effect on intumescing properties, but the three key raw materials that give intumescent properties are melamine powder (blowing agent), ammonium polyphosphate (acid donor) and polyalcohols (carbon donor). The intumescing process starts at 200-250 °C. The main stages, when paint is exposed to fire and starts to intumesce, are as follows:

1. The binder melts, facilitating chemical reactions in a soft matrix
2. The acid donor decomposes to form polyphosphoric acid
3. The polyphosphoric acid reacts with the carbon donor to form polyphosphoric acid esters
4. The esters decompose to form a foaming carbon matrix
5. The blowing agent releases gases that cause the carbon matrix to create foam that expands to form a tough insulating char barrier that adheres to the substrate

Perstorp’s Charmor range of micronized polyalcohols has been developed to ensure the very best in performance and protection.

In this technical information leaflet two water-borne starting formulations are presented. These intumescent paints are based on a non-plasticized copolymer dispersion based on vinyl acetate and vinyl ester of versatic acid. The carbon donors are:

1. Charmor® PM40 micronized below 40 µm
2. Charmor® PM15 supermicronized below 15 µm
Comments

- The information given is mainly to illustrate the basic composition of the intumescent paint. The detailed processing procedures should be adjusted according to local demands.
- Types of emulsions other than the Mowilith type quoted can be used. However, polyvinyl acetate normally provides better fire resistance than acrylates.
- Dispersions containing some chlorinated co-monomers like vinyl chloride may further improve fire resistance.
- Ammonium polyphosphate and melamine with a specified particle size are required in the formulations for easy dispersal of the paints.
- Charmor® DP40 and Charmor® DP15 can be used to improve water resistance.
- The formulation can be optimized by varying the amount of the main components, the synergist, defoamer and pigment volume concentration.
- The solid content is normally increased for airless high pressure spray application of the paint.
- Contact Perstorp for further details.
## Paint formulations

### Materials

<table>
<thead>
<tr>
<th>Part I, Grinding part</th>
<th>Charmor™ PM40</th>
<th>Charmor™ PM15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>14.2</td>
<td>14.2</td>
</tr>
<tr>
<td>Disperbyk 190</td>
<td>1.0</td>
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</tr>
<tr>
<td>Kronos 2063</td>
<td>6.0</td>
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</tr>
<tr>
<td>Charmor® PM40</td>
<td>9.0</td>
<td>--</td>
</tr>
<tr>
<td>Charmor® PM15</td>
<td>--</td>
<td>9.0</td>
</tr>
<tr>
<td>Aerosil 200</td>
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<td>1.0</td>
</tr>
<tr>
<td>Melafine</td>
<td>7.5</td>
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</tr>
<tr>
<td>Exolit APP 422</td>
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</tr>
<tr>
<td>Byk 080</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Natrosol Hr 250, 2% water solution</td>
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<td>4.0</td>
</tr>
</tbody>
</table>

### Part II, Let down

| Mowilith DM 230       | 25.0          | 25.0          |
| NX 795                | 1.3           | 1.3           |
| Sodium Polyphosphate, 10% water solution | 0.75 | 0.75 |
| Water                 | 8.0           | 8.0           |
| Total                 | 100.00        | 100.00        |

### Procedure

**Grinding part**
- Mix part I in a high speed dissolver (3000-4000 rpm, 20-30 minutes).

**Let down**
- Add part I and the rest of the raw materials to the binder, stirring continuously.
Fire testing
Preparation of test specimens
Primed metal panels (4 mm) were painted with a brush in 6-8 coats to obtain a dry film thickness of 800 
µm. Airless high pressure spray equipment can be used to apply a single coat of 800-1000 µm. The panels 
were dried for 4 weeks in a constant climate room (23°C and 50% RH) before the fire test.

To improve abrasion resistance and water resistance a thin coat of a conventional paint may be applied to 
the intumescent paint.

Fire test
Fire tests were performed in a furnace heated with a propane burner. The temperature increase in the 
furnace was controlled according to SIS 02 48 20 (ISO 834—1975). Prepared metal panels were placed on 
top of the oven. The coated side pointed downwards but was not in direct contact with the flame. The 
temperature of the panel was recorded at various points on the rear with thermocouples.

Conclusions
Charmor® PM15 and PM40 present excellent properties in water-borne intumescent paints. 
The PM15 prolongs the time to reach 500°C, but the foam is slightly fluffier.