Functional Emulsion **SIFCLEAR™**

**JSR Corporation**
Performance Chemicals Division, Dept.2

*SIFCLEAR is trademark under application by JSR Corporation.*
SIFCLEAR is water-borne emulsion made of hydrophobic units and hydrophilic units compatibilized with molecular level.

**The feature of SIFCLEAR**

1. **High weather resistances** due to the fluorine and the silicone functionalities.
2. **High stain resistance** by optimized hydrophobic and hydrophilic.
3. Heat reflection paint with SIFCLEAR has **ever lasting heat reflection effect** thanks to high stain resistance.
4. Both **baking** and **air drying** are possible.
5. Since it is water-borne resin, it is an **environment-friendly material**.

**Hydrophobic units**
- Vinylidene fluoride polymer (F Series)
- Siloxane polymer (S series)

**Hydrophilic units**
- Cross linked modified poly-aclylate.
1. Weather resistance of SIFCLEAR

Metal weather test results.

* This data does not guarantee quality.

SIFCLEAR has **high weather resistance** enough to withstand **20 years of outdoor use**.

* **SIFCLEAR F101 (white enamel)**

* **Conventional acrylic emulsion**

**<test condition>**
- Radiation 4 hours 63 degrees 40% RH (80 mW/cm²).
- Dew condensation 4 hours 30 degrees 98% RH.
- Water spray (10 sec) between radiation and dew condensation.

Equivalent for 10 years of outdoor exposure

20 years
2. Stain resistance of SIFCLEAR -Mechanism-

The coatings outermost layer is in the state where the hydrophobic portion and the hydrophilic property portion were intermingled with the molecular levels, by SIFCLEAR.

**Case of SIFCLEAR**
- Dirt is difficult to stick.
- Even if it sticks, dirt is washed away easily due to the balance of hydrophobic/hydrophilic.

**Case of conventional fluorinated resin**
- Dirt is difficult to stick.
- Once dirt sticks, it does not easily washed away by water.

**Case of conventional acrylic resin**
- Dirt sticks easily.
- Dirt is not washed away easily.

By **controlling hydrophobic/hydrophilic balance at molecular level**, SIFCLEAR realizes high stain resistance.
2. Stain resistance of SIFCLEAR -Surface Wetting-

Surface Wetting changes over time.

Gradual change in surface wetting leads High stain resistance of SIFCLEAR.

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Field test on reservoir tank in JSR (since Aug. 2011).

Fluorinated resin

SIFCLEAR F102

Stain of rain flow

No stain

Field test demonstrated superior stain resistance of SIFCLEAR.

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3. Application of SIFCLEAR: Heat reflection paint

Heat reflection paint with SIFCLEAR maintains its performance longtime.

Stained surface decreases heat reflection performance.

Solar light reflectivity decreases 15% or more.

Solar light reflectivity decreases only 3%.

Heat reflection performance improves by the high stain resistance of SIFCLEAR.

* This data does not guarantee quality.
3. Improved Heat Reflection performance by SIFCLEAR

Temperature inside hut was monitored for 1 year @ JSR Yokkaichi plant.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Freshly painted</th>
<th>One year later</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpainted</td>
<td>SIFCLEAR</td>
<td>Unpainted</td>
</tr>
<tr>
<td>Max temperature (inside)</td>
<td>39.3°C (basis)</td>
<td>33.8°C (⊿5.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>43.7°C (basis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37.3°C (⊿6.4)</td>
</tr>
<tr>
<td></td>
<td>-14.0%</td>
<td>-14.6%</td>
</tr>
</tbody>
</table>

High stain resistance of SIFCLEAR keeps heat reflection performance for long time.

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### 4. Physical Properties of SIFCLEAR

**SIFCLEAR™**

<table>
<thead>
<tr>
<th></th>
<th>Vinylidene fluorides (F) series</th>
<th>Siloxane (Si) series</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F101</td>
<td>F102</td>
</tr>
<tr>
<td><strong>Depositions</strong></td>
<td><strong>Drying methods</strong></td>
<td><strong>Baking</strong></td>
</tr>
<tr>
<td><strong>Minimum filming temperatures (MFT)</strong> [℃]</td>
<td>47</td>
<td>&lt;20</td>
</tr>
<tr>
<td><strong>Water-borne emulsion properties</strong></td>
<td><strong>Solids contents (TSC)</strong> [%]</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td><strong>Viscosity</strong> [mPa-s]</td>
<td>1000</td>
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<tr>
<td></td>
<td><strong>Particle size</strong> [nm]</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td><strong>Ionics</strong></td>
<td>Anions</td>
</tr>
<tr>
<td></td>
<td><strong>PH</strong></td>
<td>8.0</td>
</tr>
</tbody>
</table>

*This data does not guarantee quality.*

**SIFCLEAR**: **environment-friendly** (water-borne), **easy drying** (air or bake).