Actual performance of cool roof and cool facade

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Abstract
Cool roofs play an important role in the global warming mitigation. However, the rapid progress of the heat island phenomenon in the urban region should be emphasized for human sustainability. Because cool roof is effective in controlling the heat island phenomenon and in energy conservation, studies on its effectiveness have been conducted in recent years. However, the performance of the cool roofs commercially available is not always expected and is often inconsistent. To improve this situation, we have been conducting a series of research on cool roofs and cool facades.

1. Long-term performance of “Cool panel” for cool envelope

Table 1. Specimens for test

<table>
<thead>
<tr>
<th>specimen</th>
<th>Deposition of cool roof</th>
<th>Deposition of cool facade</th>
<th>Deposition of cool facade</th>
<th>Deposition of cool facade</th>
<th>Deposition of cool facade</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>Appearance: Snow White</td>
<td>Appearance: Snow White</td>
<td>Appearance: Snow White</td>
<td>Appearance: Snow White</td>
<td>Appearance: Snow White</td>
</tr>
<tr>
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<td>Appearance: Beige</td>
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<td>Appearance: Beige</td>
</tr>
<tr>
<td>Gray</td>
<td>Appearance: Gray</td>
<td>Appearance: Gray</td>
<td>Appearance: Gray</td>
<td>Appearance: Gray</td>
<td>Appearance: Gray</td>
</tr>
</tbody>
</table>

Performance of transparent and opaque facade

Figure 11. Spectral transmissivity of typical glass

Overview of reflectivity indicated by the theoretical relation

The following parameters were continuously measured: ambient temperature and surface temperature by T-CC thermocouple; solar irradiance by a pyranometer (EKO, MS802); long-wave irradiance by an infrared thermometer (EKO, MS802); reflectivity and transmissivity; and transmittance by a spectrophotometer (Perkin Elmer, Lambda 950).

2. “Cool façade” An alternative for cities in hot climates

Figure 12. Method for measuring solar radiation reflectivity of the facade

Performance of transparent and opaque facade

The tests were carried out at a site in the suburbs of Tokyo, Japan, where the climate is moderate and wet. At the site, an inland university campus, a more focused test was carried out following the preliminary test at the site. In addition, the following parameters were continuously measured: ambient temperature and surface temperature by T-CC thermocouple; solar irradiance by a pyranometer (EKO, MS802); long-wave irradiance by an infrared thermometer (EKO, MS802); reflectivity and transmissivity; and transmittance by a spectrophotometer (Perkin Elmer, Lambda 950).

Figure 13. Solar radiation reflection off the facade

Comprehensive evaluation of the facade

In conclusion, the results of the research on cool facades presented in this study indicate the importance of considering the following factors: the choice of substrate material, the selection of paint types, the method of deposition, and the method of evaluation. By considering these factors, we can improve the performance of cool facades and contribute to the development of sustainable urban environments.