

Solar Reflectance, Thermal Emittance and Solar Reflectance Index (SRI)

Technical Information

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Increasingly there is a requirement for the solar reflectance index (SRI) of materials used for roofing to be known, in particular for buildings in warm and hot climates where the main energy concern is cooling control rather than heating control and which may have to achieve LEED (Leadership in Energy and Environmental Design) certification. The SRI value is determined from a material's solar reflectance and thermal emittance.

Solar reflectance and thermal emittance are important factors affecting surface and near-surface ambient air temperature. Surfaces with low solar reflectance, absorb a high fraction of the incoming solar energy. A fraction of this absorbed energy is conducted into ground and buildings, a fraction is convected to air (leading to higher air temperatures), and a fraction is radiated to the sky. For equivalent conditions, the lower the emissivity of a surface the higher its steady-state temperature. Surfaces with low emissivity cannot effectively radiate to the sky and, therefore, get hot.

The temperatures of opaque surfaces exposed to solar radiation are generally

higher than the adjacent air temperatures. In the case of roofs or walls enclosing conditioned spaces, increased inward heat flows result. The extent to which solar radiation affects surface temperatures depends on the solar reflectance of the exposed surface.

A solar reflectance of 1.0 (100 % reflected) would mean no effect on surface temperature while a solar reflectance of 0 (none reflected, all absorbed) would result in the maximum effect.

- **Solar Reflectance** is the fraction of the solar energy that is reflected by a roof, expressed as a number between 0 and 1 or as a percentage. The higher the value, the better the roof reflects solar energy.
- **Thermal Emittance** is the amount of absorbed heat that is radiated from a roof, expressed as a number between 0 and 1 or as a percentage. The higher the value, the better the roof radiates heat.
- **Solar Reflectance Index (SRI)** indicates the roof's ability to reject solar heat, and is the combined value of reflectivity and emittance. It is defined so that a standard black is zero (reflectance 0.05, emittance 0.90) and a standard white is 100 (reflectance 0.80, emittance 0.90). Because of the way SRI is defined, very hot materials can have slightly negative



SRI values, and very cool materials can have SRI values exceeding 100.

For painted materials both solar reflectance and emittance properties are a function of the pigments used to achieve the colour as well as the type of paint system used. In some cases SRI data for a paint system is available from the paint manufacturers. However, care should be taken that even matched colours may have different SRI values if supplied from different manufacturers. It is highly likely that any custom matched colour will require specific testing and advice should be sought about the time and cost implications. Tables 1 and 2 below give solar reflectance, thermal

emittance and SRI values for PVDF coil coated aluminium from various suppliers.

Although SRI values are usually associated with paint and surface finishes a series of tests have been carried out on non-painted aluminium surfaces used for the production of Kalzip Roof and Façade Systems and Kalzip Foldable material, see Tables 3 and 4 below.

It should be noted that in cold and temperate climates buildings may not necessarily benefit from having a material with a high SRI value or “cool roof” as this could invariably lead to increased energy usage for heating.

Table 1

Solar Reflectance, Emittance and Solar Reflectance Index (SRI) of PVDF coil coated aluminium for Kalzip Roof and Façade Systems				
Colour	RAL/BS Code	Solar Reflectance	Thermal Emittance	SRI
Pure White	RAL 9010	0.777	0.85	95
Cream	RAL 9001	0.732	0.86	89
Light Ivory	RAL 1015	0.688	0.86	83
Ivory	RAL 1014	0.629	0.85	75
Grey White	RAL 9002	0.615	0.82	72
Metallic Silver	RAL 9006	0.616	0.67	67
Sand Yellow	RAL 1002	0.528	0.86	61
Light Green	RAL 6027	0.515	0.87	60
Fudge	BS 08-C-35	0.519	0.84	59
Light Grey	RAL 7035	0.512	0.85	58
Goose-wing Grey	BS 10-A-05	0.443	0.85	49
Agate Grey	RAL 7038	0.402	0.85	43
Olive Yellow	RAL 1020	0.325	0.84	37
Grey Beige	RAL 1019	0.318	0.86	33
Pigeon Blue	RAL 5014	0.283	0.86	28
Squirrel Grey	RAL 7000	0.261	0.84	24
Dusty Grey	RAL 7037	0.238	0.87	23
Basalt Grey	RAL 7012	0.138	0.87	10
Slate Grey	RAL 7015	0.119	0.85	6

Notes

1. Solar reflectance determined in accordance with ASTM E903
2. Thermal Emittance determined in accordance with ASTM C1371
3. SRI calculated in accordance with ASTM E-1980
4. Information provided by Euramax Coated Products Ltd and Becker Ltd

Table 2

Solar Reflectance, Emittance and Solar Reflectance Index (SRI) of PVDF coil coated aluminium for Kalzip Roof and Façade Systems supplied in North America				
Colour	Valspar Code	Solar Reflectance	Thermal Emittance	SRI
Polar White	431A895	0.65	0.85	78
Bright Silver	439ZZ221M	0.60	0.77	68
Sandstone	433B315	0.54	0.86	63
Light Stone	433B182	0.53	0.86	61
Copper Penny	439Z637M	0.49	0.85	55
Aged Copper	435B425	0.47	0.85	53
Teal Patina	435B447	0.37	0.86	39
Patina Green	435B411	0.28	0.87	28
Colonial Red	434A897	0.23	0.85	20
Stone Gray	432B172	0.21	0.87	19
Aegean Blue	436B296	0.21	0.86	18
Yorktown	432B135	0.19	0.83	14
Regal Blue	436B194	0.16	0.86	12
Quaker Gray	432B171	0.13	0.88	9
Evergreen	435B187	0.12	0.85	6
Dark Bronze	437B473	0.7	0.88	1

Notes

1. Solar reflectance determined in accordance with ASTM C-1549
2. Thermal emittance determined in accordance with ASTM C-1371
3. SRI calculated in accordance with ASTM E-1980
4. Information provided by Valspar Corporation

Table 3

Solar Reflectance, Emittance and Solar Reflectance Index (SRI) of Kalzip non-painted material			
Material	Solar Reflectance	Thermal Emittance	SRI
Stucco Embossed aluminium (new)	0.79	0.06	76
Stucco embossed aluminium (weathered) AluPlusPatina	0.52	0.30	35
AluPlusZinc	0.35	0.30	5

Notes

1. Solar reflectance determined in accordance with ASTM C-1549
2. Thermal emittance determined in accordance with ASTM C-1371
3. SRI calculated in accordance with ASTM E-1980

Table 4

Solar Reflectance, Emittance and Solar Reflectance Index (SRI) of Kalzip Foldable material			
Material	Solar Reflectance	Thermal Emittance	SRI
TitanSilver (weathered aluminium)	0.52	0.30	35
Falzinc	0.35	0.30	5

Notes

1. Solar reflectance determined in accordance with ASTM C-1549
2. Thermal emittance determined in accordance with ASTM C-1371
3. SRI calculated in accordance with ASTM E-1980