

Roof Coatings

General Description

Roof Coatings, White

White roof coatings contain transparent polymeric materials, such as acrylic, and a white pigment, such as titanium dioxide (rutile), to make them opaque and reflective. Other white pigments sometimes used are the anatase form of titanium dioxide, and zinc oxide. These coatings typically reflect 70 to 80 % of the sun's energy. Despite the white appearance, these pigments strongly absorb the 5 % or so of the sun's energy which falls in the ultraviolet. Thus, the pigments help protect the polymer material and the substrate underneath from uv damage.

These coatings are applied in thicknesses considerably greater than typical white paints, ranging up to about 1 mm. Some of the Oak Ridge data in the table show how the reflectance increases with thickness. The substrate must be clean and compatible with the coating system. The achievement of the very highest reflectance values requires sufficient pigment and a smooth substrate. If the substrate is already light in color, it can be made highly reflective with less pigment (fewer coats).

To help maintain the high reflectance of a freshly applied white coating, several issues are important. A completely horizontal roof, with ponding water after rain, is likely to become quickly soiled, with a corresponding loss in reflectance. Of course it is also very likely to fail by leaking! A mildewcide additive can retard biological growth with its resulting stains. There is some variation in how tightly dirt adheres to coatings. Rohm & Haas of Philadelphia is a company which has worked to improve the "cleanability" of coatings.

Table 2. Solar Reflectance and Thermal Performance of Roof Coatings (White)

Product	<u>Solar Reflectance</u>	<u>Infrared Emittance</u>	<u>Temperature Rise</u>	<u>Solar Reflectance Index</u>	Reference
KoolSeal Elasto-metric on Shingles	0.71	0.91	22 F	88	FSEC 1
Henry White Coating on Shingle	0.71	0.9	23 F	87	LBNL 2
Aged Elastometric on plywood	0.73	0.86	21 F	89	FSEC 1
Flex-tec Elasto-metric on Shingles	0.65	0.89	28 F	79	FSEC 1
New Insultec on wood, thickness 0.5mm	0.841	0.89	10 F	106	DSET 1
Insultec on metal swatch	0.78	0.90	16 F	97	FSEC 1
Enerchron on metal swatch	0.77	0.91	17 F	96	FSEC 1
White Coating (1 coat, 8 mils)	0.80	0.91	14 F	100	LBNL 2
White Coating (2 coats, 20 mils)	0.85	0.91	9 F	107	LBNL 2

Triangle Coatings, Toughkote	0.85	0.91	9 F	107	LBNL 1
Triangle Coatings, Trilastic	0.83	0.91	11 F	104	LBNL 1
Triangle Coatings, high reflectance 7	0.84	0.91	10 F	106	LBNL 1
National Coatings, Acryshield	0.83	0.91	11 F	104	LBNL 1
Utrecht acrylic, titanium white	0.83	0.91	11 F	104	LBNL 1
Guardcoat, white	0.74	0.91	20 F	92	LBNL 1
Koolseal elastomeric	0.81	0.91	13 F	102	LBNL 1
MCI, elastomeric	0.80	0.91	14 F	100	LBNL 1
Nexus/Visuron elastomeric	0.851	0.9	9 F	107	LBNL 4

More white coatings:

Product	Solar Reflectance	Infrared Emittance	Temperature Rise	Solar Reflectance Index	Reference
White Coating 1 (76.2 um)	0.60	0.91	33 F	72	ORNL 1
White Coating 1 (191 um)	0.72	0.91	22 F	89	ORNL 1
White Coating 1 (356 um)	0.77	0.91	17 F	96	ORNL 1
White Coating 1 (660 um)	0.79	0.91	15 F	99	ORNL 1
White Coating 2 (381 um)	0.81	0.91	13 F	102	ORNL 1
White Coating 2 (889 um)	0.81	0.91	13 F	102	ORNL 1
White Coating 2 (1143 um)	0.82	0.91	12 F	103	ORNL 1
White Coating 3 (152 um)	0.68	0.91	25 F	83	ORNL 1
White Coating 3 (254 um)	0.75	0.91	19 F	93	ORNL 1

White Coating 3 (304 um)	0.78	0.91	16 F	97	ORNL 1
White Coating 3 (381 um)	0.77	0.91	17 F	96	ORNL 1
White Coating 3 (686 um)	0.80	0.91	14 F	100	ORNL 1
White Coating 3 (1143 um)	0.80	0.91	14 F	100	ORNL 1
White Coating 4 (127 um)	0.68	0.91	25 F	83	ORNL 1
White Coating 4 (279 um)	0.78	0.91	16 F	97	ORNL 1
White Coating 4 (508 um)	0.80	0.91	14 F	100	ORNL 1
White Coating 4 (1143 um)	0.80	0.91	14 F	100	ORNL 1

Coatings, Tinted

Colored coatings, especially light colors, are usually produced by adding tints to white coatings. Thus white is usually the least expensive color. Usually, the tinting process greatly reduces the solar reflectance. This table includes reflectance values measured by Craig Smith on coatings formulated by SPM Thermo-shield, Inc of Custer, SD. Note that the color "raw cotton" is quite reflective. This is a light yellow similar in appearance to a manila folder. It is even more reflective than the color "white stucco," a thick white coating with a rough texture. The relatively dark red, green, and blue colors all have reflectances below 20%.

Table 3. Solar Reflectance and Thermal Performance of Roof Coatings (Tinted)

Product	<u>Solar Reflectance</u>	<u>Infrared Emittance</u>	<u>Temperature Rise</u>	<u>Solar Reflectance Index</u>	Reference
White Coating (1 coat, 8 mils)	0.80	0.91	14 F	100	<u>LBNL 2</u>
White Coating (2 coats, 20 mils)	0.85	0.91	9 F	107	LBNL 2
No pigment (1 coats, 18 mils)	0.36	0.91	55 F	40	LBNL 2
No pigment (2 coats, 36 mils)	0.54	0.91	38 F	64	LBNL 2
Raw Cotton (1 coats, 8 mils)	0.74	0.91	20 F	92	LBNL 2
Raw Cotton (2 coats, 26 mils)	0.79	0.91	15 F	99	LBNL 2
Gray Goods (1 coats, 8 mils)	0.40	0.91	51 F	45	LBNL 2
Gray Goods (2 coats, 18 mils)	0.40	0.91	51 F	45	LBNL 2

Desert Ridge (1 coats, 14 mils)	0.36	0.91	55 F	40	LBNL 2
Desert Ridge (2 coats, 30 mils)	0.36	0.91	55 F	40	LBNL 2
Red Pot (1 coats, 10 mils)	0.16	0.91	72 F	14	LBNL 2
Red Pot (2 coats, 22 mils)	0.17	0.91	71 F	16	LBNL 2
Green Gate (1 coats, 8 mils)	0.15	0.91	73 F	13	LBNL 2
Green Gate (2 coats, 16 mils)	0.16	0.91	72 F	14	LBNL 2
Charcoal Blue (1 coats, 16 mils)	0.12	0.91	76 F	9	LBNL 2
Charcoal Blue (2 coats, 32 mils)	0.12	0.91	76 F	9	LBNL 2
White Stucco (1 coats, 36 mils)	0.60	0.91	33 F	72	LBNL 2
White Stucco (2 coats, 86 mils)	0.67	0.91	26 F	82	LBNL 2
Brown on wood shingle	0.22	0.90	67 F	22	FSEC 1

Roof Coatings, Aluminum

Aluminum roof coatings generally employ an asphalt-type resin containing "leafing" aluminum flakes. The term leafing refers to the tendency of the aluminum flakes to accumulate at the exposed upper portion of the coating, which is accomplished with specialized coatings on the flakes. Thus the upper surface is a nearly continuous aluminum layer, which protects the asphalt material from the sun's ultraviolet rays. The aluminum flakes greatly enhance the solar reflectance over the 4 % value for bare asphalt, to above 50 % for the most reflective coatings. The industry regards a visible reflectance above 50 % as a bright coating. (For aluminum coatings, it happens that the visible reflectance is roughly equal to the solar reflectance. This is not true in general due to the fact that about 1/2 of the solar energy content is in the invisible near-infrared region.)

While the 50 % solar reflectance of a bright aluminum roof coating is a great improvement over the performance of a black material, the aluminum content has the offsetting effect of lower infrared emittance.

Table 4. Solar Reflectance and Thermal Performance of Roof Coatings (Aluminum)

Product	Solar Reflectance	Infrared Emittance	Temperature Rise	Solar Reflectance Index	Reference
Aluminum	0.61	0.25	48 F	50	FSEC 1
Lomit on Shingle	0.54	0.42	51 F	46	FSEC 1
Premium nonfibered on black	0.56	0.41	49 F	48	LBNL 1

Premium nonfibered on a rough surface	0.55	0.42	50 F	47	LBNL 1

Non-fibered on black	0.52	0.44	53 F	43	LBNL 1

Fibered on black	0.40	0.56	62 F	30	LBNL 1

Premium fibered on a rough surface	0.37	0.58	64 F	26	LBNL 1

Emulsion on a rough surface	0.30	0.67	68 F	21	LBNL 1
