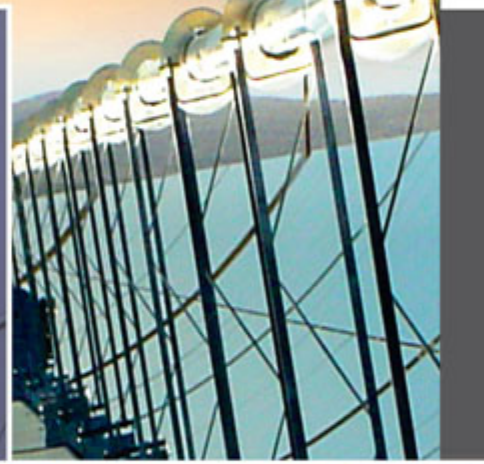


Alubond U.S.A

Solar Collector Mirror

Light-Weight Composite Metallic Mirror

ALUBOND SOLAR COLLECTOR MIRROR

Alubond Solar Collector Mirror (ASCM) is a result of pioneering research in metal composite technology. Alubond solar collector Mirror is invented, design and developed in USA by Mulk RE's Khurram Khan Nawab. American Building Technologies Inc, brings this innovation to CSP, CPV and Booster Mirror PV systems that is superior to the conventional glass mirror technology being currently used which is heavy, expensive and highly breakable.

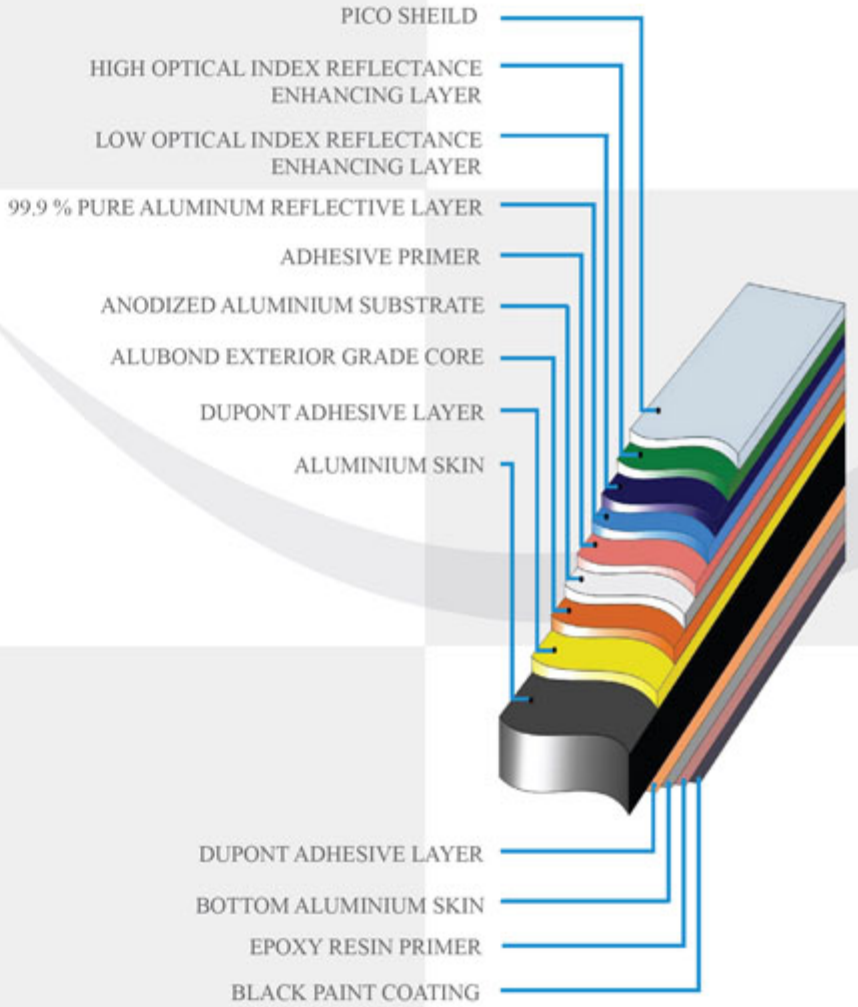
The ASCM is a unique worldwide patented composite panel, sandwiching a high durable exterior grade core between two layers of metal skin. the ASCM is light weight, features phenomenal flatness which retains its shape and comes with low maintenance. This translates in to easier handling, packaging and shipping.

The ASCM requires minimum support structure assembly thereby maximizing ease of installation and fabrication. This results in cost saving in assembly of solar units.

ASCM is designed to provide high reflectivity along with rigidity to take and retain parabolic shapes. ASCM's have high reflectance ranging from 91% to 95%, strong weather and corrosion resistance, longevity and adhesion properties that provide an advanced alternative to the glass mirror technology.

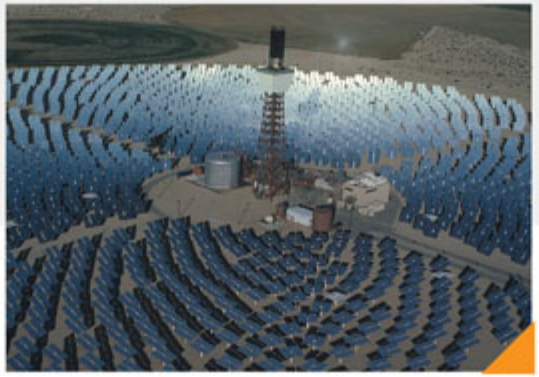
COMPOSITION

Alubond Solar Collector Mirrors (ASCM) are the new generation multilayered metal and plastic composite panels.



ALUBOND SOLAR COLLECTOR MIRROR - APPLICATIONS

Mulk R.E System

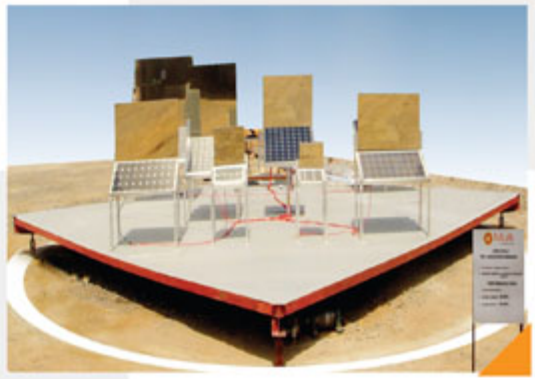


Heliostat System

CSP Dish Systems

Fresnel CSP Systems

Parabolic Trough System



Alubond PV Booster Mirror

ALUBOND SOLAR COLLECTOR MIRROR Vs. GLASS MIRROR

- Conventional glass mirrors are heavy and require complex substructure support

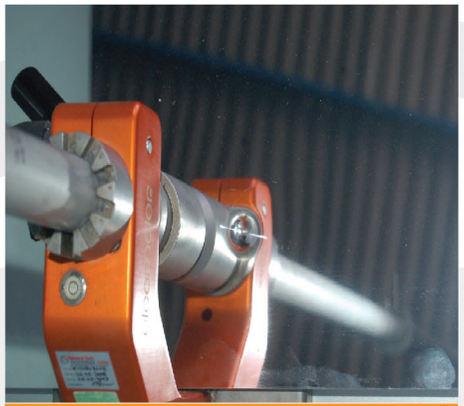
ASCM

- LIGHT WEIGHT: 3Kgs/m^2
- SUBFRAME: Simple frame
- SHAPE: Achieves deep parabolic angle

CONVENTIONAL GLASS MIRROR

- HEAVY WEIGHT: 10Kgs/m^2
- SUBFRAME: Complex subframe
- SHAPE: Lower parabolic angle

ALUBOND SOLAR COLLECTOR MIRROR – ADVANTAGES

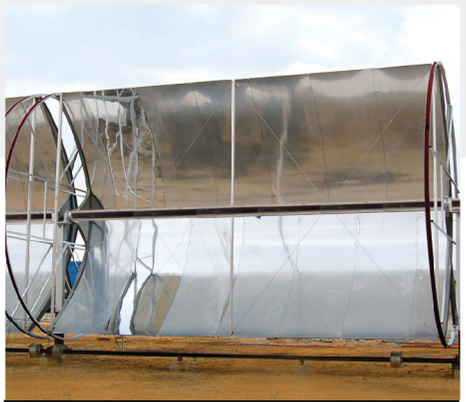


Unbreakable

On Site Curvature

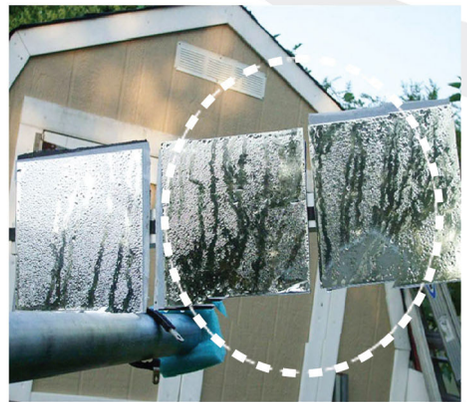
Mass Production

Minimal Substructure



Reduced Weight

Retains Shape



Hydrophilic Effect

High UV Resistance

PRODUCT CHARACTERISTICS - ASCM 91/95

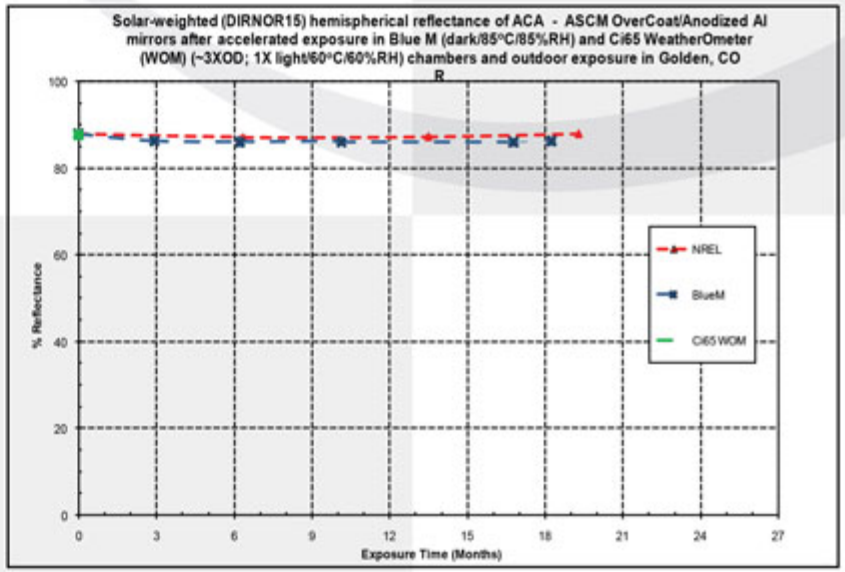
MECHANICAL PROPERTIES		
DESCRIPTION	ASCM 91 / 95	TEST STANDARD
Tensile strength (PSI)	180 N/mm^{2} (26000)	ASTM D 638 -03
Elongation %	4%	ASTM D 638 -03
Minimum T bend radii	1T	ASTM D 638 -03
Yeild strength (PSI)	165 N/mm^{2} (24000)	ASTM D 638 -03
180° Bend Test	No Coating Failure	BS EN ISO 1519 ASTM D 4145-83
Falling Ball Impact Test	No Coating Failure	BS EN ISO 6272-1 ASTM D 1400 - 94

WEATHER RESISTANCE PROPERTIES			
DESCRIPTION	SOLAR REFLECTION LOSS		TEST STANDARD
	ASCM 91	ASCM 95	
QUV Test (3000 h)	<1%	<0.5 %	ASTM GC 154-06
Salt Spray Test (3000 h)	<1.5%	<3 %	ISO 9227
Coefficient of Thermal Expansion (CTE)	+/-0.1 mm Per m^{2}		ASTM D696 - 03
Temperature Resistance	- 50° C TO + 80° C		ASTM D976
Exterior & coating warranty	25 Years		
Protective coating	PICO Sheild		

ALUBOND SOLAR COLLECTOR MIRROR Vs CONVENTIONAL SOLAR GLASS MIRROR

SYSTEM COMPONENT MIRROR	CONVENTIONAL GLASS MIRROR SYSTEM	ALUBOND SOLAR COLLECTOR MIRROR
Reflector panel	Heavy Mirror	3 mm Composite Metal
Maintenance	Intensive	Minimal
Exterior warranty	15 to 20 years	25 years
Abrasion resistance	Good	PICO Sheild Coating for Anti Abrasion
Protection in inverted mode	Nil	Metal Skin Protection
Parabolic shape retention	Difficult	Easy
Substructure	Heavy	1/4 th of mirror - Light weight
Loss of reflectivity	Less than 5% in 15 years	Less than 4% in 20 yaers

Recent results-NREL Specula Reflectance with Total Hemispherical Reflectometer: Note Consistencies of measurements is good In Real Time RESULT 5 YEARS NO LOSS OF REFLECTIVITY, NO DEGRADATION.



ASCM (PICO SHEILD) VS CONVENTIONAL GLASS MIRROR COATING

PROPERTIES	ASCM	CONVENTIONAL GLASS MIRROR	TEST STANDARD
Dry Film Thickness	10-11 Microns	Infromation not available	DIN EN 13523 – 1, ASTM D 339 - 92a
Resistance to Salt Spray Test	600 Hrs - PASSED	480 Hrs - PASSED	DIN EN ISO 9227 NSS, ASTM B 117 -07
Resistance to Humidity	600 Hrs- PASSED	480 Hrs - PASSED	DIN EN ISO 6270 - 2 CH, ASTM D 2247-02
Crosscut Adhession Test	PASSED	Infromation not available	DIN EN 13523 – 6, ASTM D 3359 - 02
T - Bend	2 T	Infromation not available	DIN EN 13523 – 7, ASTM D 4145-83 (2002)
MEK Test	60 DBR	Infromation not available	MEK TEST - ASTM D 4752

ASCM REFLECTANCE PROPERTIES Vs CONVENTIONAL GLASS MIRROR

CONVETIONAL GLASS MIRROR	TOTAL SOLAR REFLECTANCE	TOTAL REFLECTANCE VISIBLE RANGE
	92 %	93 %

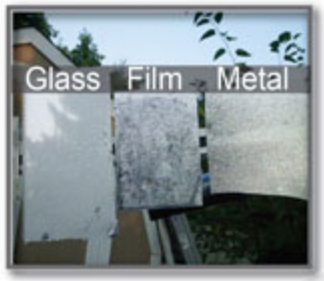
	PRODUCT RANGE	TOTAL SOLAR REFLECTANCE	TOTAL REFLECTANCE VISIBLE RANGE
ALUBOND SOLAR COLLECTOR MIRROR (ASCM)	ASCM 91	91.0 %	91.4 %
	ASCM 95	95.0 %	94.0 %

HYDROPHILIC PRINCIPLE (SELF CLEANING EFFECT)

Alubond Solar Collector Mirror have special innovative coating which uses Hydrophilic Principle in which the physical property of a molecule repels from a mass of water. This was observed when water was placed on the Alubond Solar Collector Mirror, water did not form droplets but instead fully wets the mirrors to have self cleaning effects.

To study the effect of this aspect on solar system performance, samples were mounted on a rack outside on a clear night. The next morning, observations were made. As shown in the picture, Alubond Solar Collector Mirror hydrophilic samples appeared to be visually clear.

Alubond
Solar Collector Mirror



Conventional
Glass / Film / Metal Mirror

www.alubond.com

www.mulkre.com

Mulk Renewable Energy

Post Box No. 50879
Hamriya Freezone, Sharjah
United Arab Emirates

Tel: +971-6-5262202
Fax: +971-6-5262203

csp@mulkre.com

Alubond U.S.A

Solar Collector Mirror

Light-Weight Composite Metallic Mirror