



Dow Construction Chemicals

## Cool Reflective Roof Coating: technology in practice

### Trakhees-EHS training building Jebel Ali Free Zone

- Collaboration of The Dow Chemical Company with Henkel Polybit and Trakhees
- Roof coating formulated with PRIMAL™ EC 4642 ME acrylic binder from Dow



### Torrent del'Olla Barcelona roof renovation project

- Result of a formal cooperation between Barcelona City Council and The Dow Chemical Company
- Roof coating formulated with PRIMAL™ EC 1791 acrylic binder from Dow

## Cool Reflective Roof Coatings (CRRC): an overview

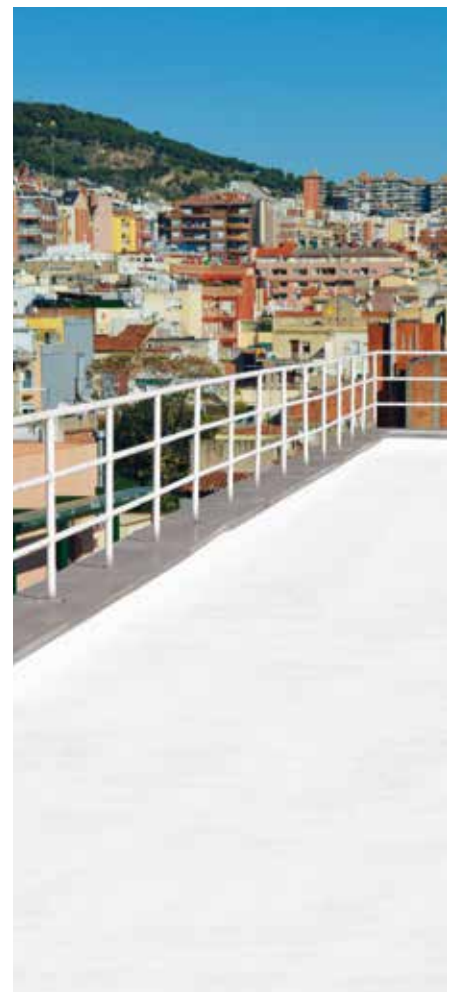
Roof surfaces are coated with materials with high solar reflectance to emit solar radiation, as well as high infra-red emissivity to release absorbed heat. Dow Construction Chemicals – a member of the European Cool Roofs Council and the Cool Roof Rating Council – has years of experience in developing technology for elastomeric cool roof coatings, expertise which is now being used to produce tailored binders supporting development of effective CRRCs around the world.

### Benefits of CRRC technology

- decreases the heat penetrating the building, reducing ambient air temperatures: less energy required for air-conditioning
- helps protect a roof from degradation through weathering: reduces maintenance requirements and extends roof lifetime
- helps to combat the urban heat island effect, which results in temperature peaks in urban areas
- simple to apply on a variety of substrates, including sloping roofs
- offers ability to achieve Leadership in Energy and Environmental Design (LEED) credits and supports Smart City ambitions

### Key requirements for the functionality of effective CRRC

- flexibility: in order to expand and contract along with the waterproofing layer
- durability: the ability to withstand mechanical and exposure stresses experienced on rooftops
- temperature resistance: to withstand high roof surface temperatures
- dirt resistance: essential for maintaining core functionality of solar reflectivity, key to achieving energy savings
- excellent adhesion in wet and dry conditions
- water resistance for long term durability

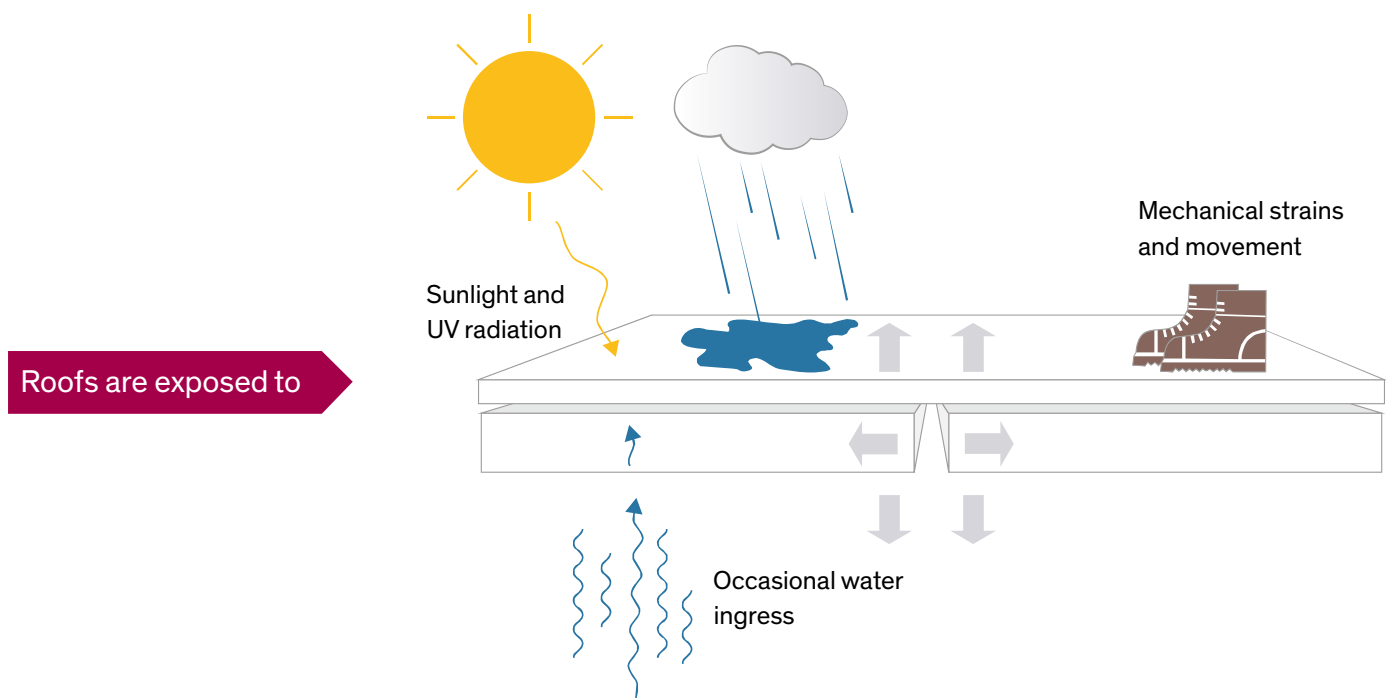


# The challenge of Roof Surfacing



Traditional dark colored bituminous and concrete roof surfaces soak up heat and transfer it into the upper floors of a building, putting additional strain on air conditioning or cooling units and increasing energy costs. Unlike bituminous and concrete roofs, cool roofs – enabled by Dow’s elastomeric acrylic technology – can significantly improve operating costs, reduce utility bills, benefit the surrounding environment and lengthen the lifespan of roofs.

Elastomeric CRRCs help create energy-saving roofs that reflect the sun’s heat and prevent it from being absorbed into the building, reducing air conditioning or cooling costs by as much as 20 percent. Because of their light color and reflective capabilities, cool roofs reduce the heat build-up common with bituminous roofing systems and ultimately extend the lifespan of the roof itself thanks to resistance to wide temperature fluctuations which can cause mechanical stresses.





## The solution – Cool Reflective Roof Coatings



### Features

- With high solar reflectance to reflect solar radiation
- With high thermal emissivity to release absorbed heat
- Decreasing the heat penetrating into the building
- Reducing ambient air temperatures and increasing thermal comfort
- Significantly lowering energy consumption/cooling loads from air-conditioning
- And above all, increasing the lifetime of roofs

### Cool Reflective Roof Coatings offer an ideal opportunity for improving energy efficiency

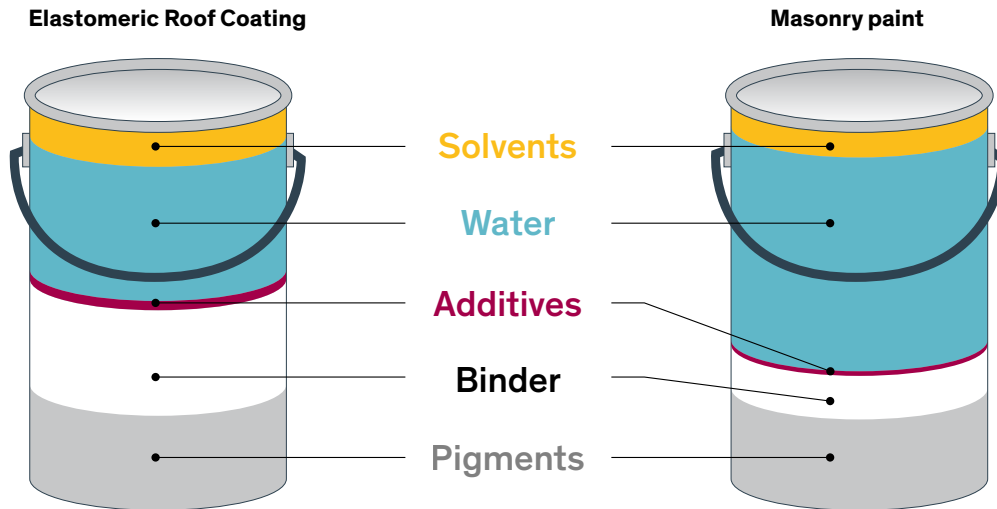
‘Green’ buildings are becoming high value properties as owners and occupiers begin to appreciate the greater potential for energy saving and reduced running costs.

Growing interest in the role that ‘cool roofs’ can play in improving the energy efficiency of buildings is increasing the demand for advanced coating technology – and consequently for effective binders which play a critical role in maintaining integrity and quality of the overall system.

Dow Construction Chemicals has years of experience in developing binders for elastomeric roof coatings to efficiently address different climatic conditions.

Elastomeric Cool Reflective Roof Coatings offer specific, additional functionalities way beyond standard masonry paint, for example, such as high solar reflectance and high infrared emissivity – as well as ability to resist wide temperature fluctuations and moisture absorption.

Cool Reflective Roof Coatings offer more than a standard masonry paint: they are functional coatings



Thickness of roof coating compared to thickness of standard masonry paint



### Acrylic/ elastomeric Roof Coatings (including CRRC)

- Resist broad temperature ranges and UV exposure
- Retain flexibility and elasticity\*
- Expand and contract alongside waterproofing membrane movement\*
- Impervious to ponding water\*
- Resist moisture absorption
- Resistant to mildew
- Offer excellent adhesion\*
- Deliver good color retention
- Withstand pedestrian traffic to enable occasional maintenance and inspection\*

\* key properties

### Masonry paints

- Resist heat and UV exposure
- Resist wetting and drying
- Resist moisture absorption
- Resist mildew
- Good adhesion properties
- Good color retention

## First Case Study:

### Trakhees-EHS training building Jebel Ali Free Zone



## Supporting an environmental pioneer

Dow acrylic emulsion was used by Henkel Polybit for a roof coating on a building owned by an environmental pioneer with an ambition to improve energy efficiency in the Middle East.

Trakhees-EHS (Environment, Health and Safety) is the regulatory arm of the Ports, Customers and Free Zone Corporation (PCFC) in Dubai. The organization has a remit to improve the sustainability of buildings in its jurisdiction. It has portfolio of green building regulations addressing different types of built environments. While EHS sustainability department started enforcement by adopting Leadership in Energy and Environmental Design (LEED) ratings as a basis, it developed its own in-house green building regulations over a period of time.

With CRRC offering potential for the Middle East to reduce energy requirements for air conditioning – and therefore have a positive impact on spiraling government subsidy costs – Trakhees-EHS was eager to embark on a test case of the technology.

### About Cool Reflective Roof Coatings

Roof surfaces are coated with materials with high solar reflectance to reflect solar radiation, as well as high infrared emissivity to release absorbed heat. Dow Construction Chemicals has years of experience in developing technology for elastomeric cool roof coatings, expertise which is now being used to produce tailored binders supporting development of effective CRRCs for the Middle East.

## Supporting an environmental pioneer with a test case

Cool Reflective Roof Coatings are by no means limited to residential or new build applications, as the application at Trakhees-EHS demonstrates. The technology also offers great potential for refurbishment, and can be applied to multiple surfaces, including bituminous membranes, concrete, polyurethane foam and galvanized steel.

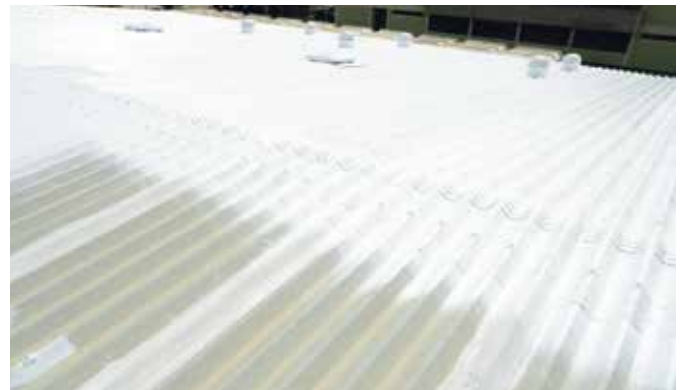
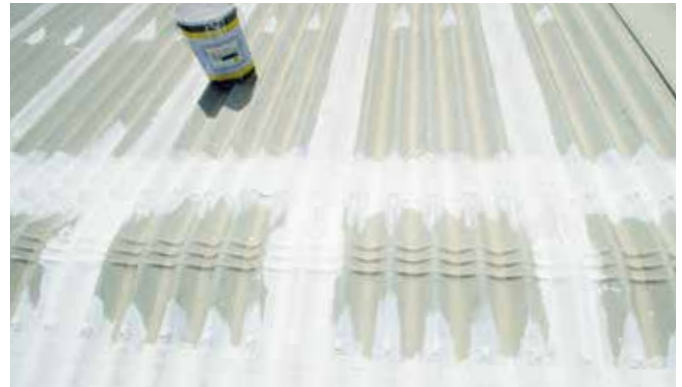
With its own one-storey training building referred to as “Green Gallery” due for renovation, Trakhees-EHS was eager to try the cool roof technology for its premises. Dow volunteered to engage a new CRRC developed by Henkel Polybit in partnership with Dow, for use as a pilot study. In this case, the substrate was a 700 m<sup>2</sup> corrugated, galvanized metal roof.

Henkel Polybit’s POLYTHERM AC coating – incorporating Dow acrylic emulsion (manufactured in Jebel Ali) – was sprayed onto the roof. Application took under two days for a five-strong team to complete.

The aim is to make working conditions much more pleasant for employees, and to test the technology for potential future applications. Studies on the effectiveness of the technology will be carried out by an independent consultant to assess the impact of the new roof coating over a period of time.

EHS-Trakhees is aiming to improve energy efficiency and working conditions in buildings throughout the development zones in its jurisdiction and there is potential to apply such CRRC technology to numerous buildings in future.

Coatings formulated with Dow polymer and in line with guidance from Dow Construction Chemicals can reach relevant ASTM standards for liquid applied acrylic coatings used in roofing applications.





## Elastomeric Cool Reflective Roof Coatings

**An environmentally advanced technology that improves the energy efficiency of buildings**





## Second Case Study:

Barcelona – a city which is embracing the Smart City concept



### A demonstration case for a city with ‘smart’ ambitions

PRIMAL™ EC 1791 from Dow Construction Chemicals was used in a Cool Reflective Roof Coating on a demonstration renovation project in Barcelona.

Barcelona City Council is actively engaged in a program known as “BCN Smart City”, and is working to improve the quality of its citizens’ lives by guaranteeing sustainable social, economic and urban development. City planners are using the platform to bring together public and private organizations to help push forward innovations that can improve the economic fortunes, environmental sustainability and comfort of Barcelona’s inhabitants for the future.

In May 2014, The Dow Chemical Company and Barcelona City Council signed an agreement whereby both parties would jointly explore potential for solutions which could advance such Smart City goals and monitor their performance, particularly in relation to energy efficiency and sustainability. Many of the sustainable solutions on offer from Dow are highly relevant to Smart City ambitions: one example is increasing interest in the benefits of Cool Reflective Roof Coating (CRRC) technology, particularly in densely populated urban areas.

In late 2014, Dow teamed up with Barcelona City Council to create a demonstration project for a building renovation on the Torrent del’Olla, with Abolin SA manufacturing the elastomeric roof coating using PRIMAL™ EC 1791 from Dow Construction Chemicals, and specialist applicator Go&Go engaged to apply it.



Outdoor temperature: 19°C

[A] Bitumen temperature: 25.8 °C, [B] Cool Roof temperature: 13.8 °C

## Elastomeric Cool Reflective Roof Coatings

Supporting future  
developments in urban  
sustainability



## Supporting future developments in urban sustainability

The Torrent del'Olla building – originally built in 1969 – houses a supermarket on its ground floor, and offices on the floors above, overall, around 300 people work within the building. One of its floors is home to a Barcelona City Council project team supporting this exciting demonstration project – after all, what better way of putting a system to the test than applying it to your own building, and then working within it!

The building has a roof surface of 710 m<sup>2</sup>, and is covered with a bituminous membrane installed over a decade ago. Whilst the roof was in reasonably good condition, cracks were beginning to show, making it an ideal opportunity to add a maintenance coating and at the same time test the CRRC concept on a renovation project.

As with many other buildings in urban environments, there were multiple existing structures such as air conditioning units and photovoltaics on the roof, meaning a liquid-applied coating was ideal – and with a key aim to test CRRC application on existing, sometimes complex structures, it was an ideal project for a team of people interested in measuring improvements in energy efficiency after a renovation. Large expanses of bituminous, black roofs – combined with the density of man-made structures – can lead to temperature peaks in urban areas, a phenomenon known as the ‘urban heat island effect’. The US Environmental Protection Agency has cited this effect as causing cities with more than a million people or more to be up to 3°C warmer than surrounding areas during daytime and as much as 12°C in evenings. Heat islands can increase summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, as well as have an impact on heat-related illness.

### Roof build-up: quick facts

Building constructed:

1969

Bituminous roof installed:

ca. 2002

Roof structure:

Ceramic tiles over mortar, overlaying continuous bituminous layer, air chamber and false ceiling in roof space above offices

Abolin SA, a specialised manufacturer of Cool Roof Coatings, prides itself on developing ‘environmentally smart solutions’ for such urban environments, and has a proven history not just in cool roofs, but cool pavement technology, particularly in Greece where daytime temperatures can be very high. Like Dow, the company is also a member of the European Cool Roof Council.

After first washing down the existing roof surface with water, Abolin’s Cool Barrier Roof system – formulated with water-borne binder PRIMAL™ EC 1791 from Dow Construction Chemicals – was applied to the roof by a three-strong team of applicators from Go&Go in approximately 10 hours in total, using rollers.

PRIMAL™ EC 1791 imparts very good durability and dirt pick-up resistance, helping to reduce the darkening of light-colored roof coatings over time for long term energy efficiency. It also offers resistance to cracks, UV-light and ponded water, as well as to potential blistering of the final coating. In addition, the reduced surface temperature and minimized water penetration will protect the underlying roof substrate and help extend its life.

Initial findings immediately after installation of the CRRC demonstrated that surface temperatures on the roof at midday had dropped from 24°C to just 14°C. The average daily temperature within the building was 24°C: monitoring has begun to see whether the use of air conditioning to maintain that temperature can be reduced, particularly during summer months, and whether this can in turn lead to reduced energy use and costs.

The results will feed into the BCN Smart City program, in order to review the potential for further applications of Cool Reflective Roof Coatings on both new and refurbished buildings in Barcelona as it continues in its ambitions to meet Smart City goals. Findings will also be shared with other Smart City programs and research centers worldwide as part of Dow’s agreement with Barcelona City Council to help promote the city’s international position as a leader in Smart City development.

Coatings formulated with Primal EC 1791 acrylic emulsion and in line with guidance from Dow Construction Chemicals can reach relevant ASTM standards for liquid applied acrylic coatings used in roofing applications.

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