Recent progress on Cool Materials in Europe: The role of European Cool Roofs Council

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Outline of the presentation

- General Context
- Development and testing of new materials
- Assessment of energy efficiency in buildings
- Assessment of urban heat island mitigation
- Standards, Measurements and the ROLE OF ECRC
Outline of the presentation

General Context

Development and testing of new materials

Assessment of energy efficiency in buildings

Assessment of urban heat island mitigation

Standards, Measurements and the ROLE OF ECRC
✓ Buildings = 40% of energy consumption and 36% of CO2 emissions in the EU.

✓ Improved energy efficiency of buildings = reduction of the total EU energy consumption by 5% to 6% and lower CO2 emissions by about 5%.

✓ Increasing urbanisation and heat island = increased energy consumption, leading to higher greenhouse gas emissions.
\textbf{COP 21 – Climate change}

- COP21 objective: global temperature below 2° C threshold
- EU policymakers to find effective solutions to meet this objective

\textbf{Energy Union}

- secure, affordable energy and wiser energy use in Europe

\textbf{Circular Economy Package}

\textbf{Cool roofs:} a practical and affordable technology that represents an untapped potential for unlocking the opportunities that lie in sustainable housing.
Cool roof benefits

- Improved energy efficiency thanks to the reduction of building heat-gain
- Improvement thermal comfort conditions in non AC buildings
- Improved lifespan of materials
- A cost effective solution that can be used in new and existing buildings
Cool roof benefits

- Savings on summertime air conditioning expenditures, in conditioned buildings. (AC savings averagely 10-40%)
- Reduction of peak electricity demand and related financial savings

Cool roof benefits

- Reduction of urban heat islands & heat resulting air pollution and greenhouse gas emissions

ΔT = 1-2 °C

Abs = 0.18
Abs = 0.63
Abs = 0.85

Cool roof benefits

- Mitigation of global warming by creating a “negative radiative forcing” & decreasing GHG emissions due to reduced energy consumption
Outline of the presentation

General Context

Development and testing of new materials

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Standards, Measurements and the ROLE OF ECRC
Significant effort is put in:

- Intelligent coatings and materials that provide a desired response to some external stimulus, such as temperature, light, etc.
- In understanding the ageing of materials.
Inorganic Thermochromic Coatings

Transition temperature: 45°C
Thermochromic coatings with various filters
Analysis of ageing effect in existing applications of cool materials where a 0.24 drop of the solar reflectance value and an increase of the cooling load 12.6 kWh/m2 is noticed.
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Tetrafluoroethylene (C$_2$F$_4$) monomer fluorocarbon coating in a water-borne (FC coating)

Herewith we are acknowledging TecneXum GmbH, Essen, Germany, and Daikin Chemical Europe, Düsseldorf, Germany, for their support and to enable us to perform these studies and to publish the results.
Application in industrial building in Oss Netherlands
Application in industrial building in Oss Netherlands

Before cool application

After cool application
✓ The value of the roof albedo has changed from 0.3 to 0.67 after the application of the cool coating.

✓ There is an increase of 120% of the roof’s albedo. Regarding the heating and cooling loads there was a decrease of 73% for cooling while there was a minor heating penalty of 5%.

✓ The overall study showed that cool materials can be a viable solution even for temperate climatic conditions and for industrial buildings where usually there is a significant burden in the cooling load due to machineries and production lines. This can make a significant difference in the use of air conditioning especially in mid seasons.
Three years after coating application, in 2015, a cleaning procedure, was carried out to clean the roof for the first time, in order to assess the performance of the coating during time.

Infrared imaging of reference area

Infrared imaging of aged and cleaned aged cool roof
After the cleaning procedure, the solar reflectance of the cool roof was 0.72. There was an increase in solar reflectance of about 19.4% after the cleaning of the roof which means that despite the high albedo reduction due to ageing, after cleaning the SR property is almost totally restored.

The infrared imaging shows a difference of 2 degrees between the reference and cleaned aged area indicating that the cleaning procedure restores by a high percentage the initial values of surface temperature of the cool coating.

The results of this study indicate the durability of the cool coating during time and the benefits of the roof cleaning in the maintenance of the optical properties.
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Case studies applications in simulation based approach using Computational Fluid Dynamics and other techniques presented in 2\textsuperscript{nd} Cool Roofs Conference:

- Serres, Florina, Agrinio, Archanes, Greece
- Case study in a region of Nantes, France

In all case studies the surface temperature decrease is > 5K

Contribution to a reduction of greenhouse gas emissions of almost 7kg/m\textsuperscript{2} of cool material.
Thermal Conditions

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<th>Points</th>
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<tr>
<td></td>
<td>B.C.S.</td>
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<tr>
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<tr>
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Development and testing of new materials
Assessment of energy efficiency in buildings
Assessment of urban heat island mitigation
Standards, Measurements and the ROLE OF ECRC
The European Cool Roofs Council (ECRC) is a non-profit European association.

It is a voluntary organization that brings value by promoting the benefits of cool roofing products to regulators, policy makers, consumers and other stakeholders.

The ECRC also enables cool materials and products to be identified through the Product Rating Scheme.

http://coolroofcouncil.eu/
ECRC members

Membership

Current ECRC Members

Below is a listing of the ECRC Members:

Companies

- AXIMM
- Daikin
- Huntsman
- Icopal
- Kaneka
- Materis
- Nanophos
- Braas Monier Building Group
- Deckers
- SOPREMA
- The Green Trading House

 Universities and Research Institutes

- Brunel University London
- CRIAT
- ENEL
- ENEA
- Nanophos
- National and Kapodistrian University of Athens
- University of Crete
- University of Lleida
- University of Marche

Cool roofs offer many benefits:

- Reduce energy required for cooling
- Lower related greenhouse gas emissions
- Improve thermal comfort
- Increase system lifespan
- Reduce maintenance costs
- Mitigates urban heat islands
- Reduced peak electricity demand

Ask about the benefits of joining ECRC

ECRC News and Events

- First products rated by the ECRC’s Product Rating Program: 25/02/2016 14:32
- 2nd Call for European testing laboratories to participate in the ECRC Product Rating program: 25/02/2015 10:55
- Initiation of the ECRC Product Rating program: 15/02/2015 10:37
- 1st Call for European testing laboratories to participate in the ECRC Product Rating program: 24/11/2014 12:44

Testimonials

Increasing the solar reflectivity of roofs and horizontal or near-horizontal surfaces around buildings and planting shade trees can yield dramatic energy savings. IPCC Fourth Assessment Report: Climate Change 2007
Cool roofs technology has long been applied and promoted in the U.S. and other countries around the world like Japan, Australia, Brazil, India etc.
ECRC Strategic objectives

- Formulation of cool roof product rating programme in Europe.
- Inclusion of cool materials in European Standards, Energy Assessment Methods.
- Promote the benefits of cool materials to engineers, stakeholders, etc.

- ✓ ECRC product rating program Fully operational and agreed within the members
- ✓ An Interlaboratory comparison (ILC) conducted
- ✓ Bridging with CEN for measurement standards development
- ✓ Actions of promotion
- ✓ Meeting Programme
A uniform and credible system for rating and reporting the radiative properties of roofing materials.

Roofing product manufacturers label various roof products with radiative property values.

The radiative properties that will be reported are the solar reflectance (SR) and the infrared emittance (e) and calculated SRI.

Radiative properties are determined and verified through testing by ECRC approved test laboratories and a process of random testing of rated products.
Initial Product Rating Manual

Technical Committee

V2_November 2013
- Weathering tests in 3 different climatic regions representing the anticipated cool roof market in Europe
- The climatic requirements for the test sites have been defined and will be updated at a later stage
- The weathering test site requirements have been defined
### ECRC Product Label

**Rated Product ID Number**

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<th>RATED PRODUCT</th>
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<table>
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European Cool Roofs Council Ratings are determined for a fixed set of conditions which may not be appropriate for determining differing seasonal performance. The actual effect of solar reflectance and thermal emittance on building performance may vary with differing conditions. The manufacturer of this product stipulates that these ratings were determined in accordance with the applicable European Cool Roofs Council procedures.
Case Studies...

- Public building, Trapani, Italy
- >700m2, walls made of ‘tufo’
- Original roof SR 0.25
- Solar reflective roof SR 0.86
- Cooling energy reduced by 54%
- ‘Cool roof is most efficient solution’
Thank you for your attention!
http://coolroofcouncil.eu/