3M Cool Roofing Granules

California Energy Committee
PAC Meeting
March 3, 2005
Cool Roofing Granules

**3M**, LBNL, and ORNL have been collaborating in the area of Cool Roofing since 1995

**Why granules?**

**Shingle Market**
- Most widespread residential roofing choice
- High consumer awareness and acceptance
- Shingle roofing costs are lower than most other alternatives
Cool Roofing Granules

- Roofing Granules
  - Weight
  - UV-Protection
  - Aesthetics
- Roofing granules comprise the vast majority of visible surface area on a shingle
- To achieve shingle reflectance values, granules must be reflective
Project Objectives

- Ultimate goal is to produce reflective granules that allow shingle manufacturers to produce reflective shingles
- The ideal way to accomplish this is to make the granules/shingles as white as possible
- For consumers, bright white shingles are not desirable aesthetically
- CEC/LBNL Program to develop cool colored roofing materials
  - Infrared reflecting pigments – absorb energy in the visible portion of the solar spectrum
Developmental Approach

• Have evaluated the following issues:

- Pigments (loadings, IRR) – expensive!
  LBNL Pigment database
- Coating(s)
- Asphalt Effects (~2-3% ↓)
- Granule Grade Effects
- Coverage Effects
- Post-treatment
Developmental Approach

Reflective Primary Coating

Can be manufactured w/ existing infrastructure

Outer Coating (contains IR-reflecting pigments)

2-Pass Coating

Base Mineral
Reflectance Comparison

**Air Mass 1.5 Hemispherical 37 Deg. Solar Reflectivities**

<table>
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<tr>
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<th>37EEC (White Basecoat)</th>
<th>37EEC (No Basecoat)</th>
<th>Standard Green</th>
<th>68 EEC 1 (White Basecoat)</th>
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**Air Mass 1.5 Direct Normal 37 Deg Solar Reflectivities**

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Post-Treatment Effects
**Post-Treatment Effects**

Weatherometer Testing - 600 Hours

- Xenon Arc => 102 min. @ 63°C, 18min. light plus water spray
- QUV (Fluorescent) => 5 Hrs at 37°C, 1 Hr dark with condensation

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Cool Granule Products

5 Cool Granule Colors – Solar Reflectance

- Cool Tan – 32%
- Cool Brown – 25%
- Cool Blue Grey – 27%
- Cool Grey – 27%
- WA9300 White – 29%
Conclusions

- Dark mineral color and granule roughness (multiple scattering events) detracts from reflectance potential
- Multipass coatings and infrared-reflecting pigments can improve relative granule reflectances
  - Resultant granule colors not as rich as standard granules
  - Process/pigments adds significantly to the cost
- Higher reflectance values can be achieved
  - Additional cost is added
  - Aesthetics further degraded
- Continuing research to generate further advances
  - Current approach provides best balance of competing factors
Future Plans

Future Directions

- Optimize coating technology
- Accelerate Agency (CRRC, Energy Star) qualifications
- Develop relationship between granule reflectance values and ultimate shingle reflectances – coating analogy
- Collaborate to quantify savings potentials of reflective granule/shingle products