Emisspro®: Innovative High Emissivity Coating For Energy Saving in Industrial Furnaces

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APMP-Midyear Symposium Dusit Thani Hall, June 8 2016
emisspro®: Innovative High Emissivity Coating for Energy Saving in Industrial Furnaces

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“You can’t **manage** what you don’t **MEASURE.**”

— PETER F. DRUCKER
Industrial... Energy consumption

Let's Save the world

Climate Change

Global warming

*Photo: www.thoughtpursuits.com
6,000,000,000,000 ton CO$_2$
Released from Industry
140,000,000,000,000 Joule of energy consumed

Chemicals & Petrochemicals 30%
Iron & Steel 19%
Cement & Minerals 9%
Paper 6%
Other 36%

*Info from IEA 2012
What if we attempt to help reduce the emission...let’s say only 0.01%
Siam Cement Group (SCG) was founded under the Royal Decree of His Majesty King Rama VI in 1913, to produce cement for domestic consumption, reducing reliance on cement imports, and laying a groundwork for country development.
103 Years of Substantial Imprints

- Founded in 1913
- Listed in 1975 on the SET
- Market cap approximately of $16 Billion (as of Jul/14)
- Major shareholder: The Crown Property Bureau 30%
- Free float of 70%
- 49,287 staffs (as of Jan/14)

Key figures (2014):
- Total Assets 465 Billion Baht ($14 Billion)
- Net Sales 503 Billion Baht ($15 Billion)
- EBITDA 61 Billion Baht ($1.9 Billion)
- Net Profit 33 Billion Baht ($1.0 Billion)
By 2015, SCG as ASEAN Sustainable Business Leader

- Role Model in Corporate Governance & Sustainable Development
- Innovative Workplace of Choice
HVA = High value added products and services

- An element of brand, technology, or service bundled
- High Margin

**Chemicals**
- "EU-certified PE water pipe"
- "Medical grade plastic"
- "High Emissivity Coating"
- "Inspection Robot"

**Cement & Packaging**
- "Color rendered mortar"
- "Lightweight packaging"
emisspro®: Innovative high emissivity coating for energy saving in industrial furnaces
90% of heat transfers in high temperature furnaces by radiation

1. Conduction \((kA/x)\Delta T\)
2. Convection \(hA\Delta T\)
3. Radiation \(\sigma\varepsilon AT^4\)
Heat distribution in fired heaters

50% transferred to the process fluids in firebox
Heat distribution in reheating furnaces

45% absorbed by steel in re-heating furnace

- Heat on steel: 45%
- Exhausted air: 23%
- Loss: 19%
- Steam: 13%
Heat distribution in ceramic kilns

38%
Absorbed by product

<table>
<thead>
<tr>
<th>Loss Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbed by product</td>
<td>38%</td>
</tr>
<tr>
<td>Stack loss</td>
<td>27%</td>
</tr>
<tr>
<td>Hot air</td>
<td>24%</td>
</tr>
<tr>
<td>Radiation loss</td>
<td>11%</td>
</tr>
<tr>
<td>Heat carried by product</td>
<td>1%</td>
</tr>
</tbody>
</table>

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Mechanism of effectiveness of Emisspro

Reduces ‘Reflective Radiation’ and increases ‘Emissive Radiation’.

So, the LOAD receives more energy using the same amount of Fuel
Why ‘High Emissivity’ means ‘Lower Energy Consumption’

High Emissivity Coating help increase “Emissivity” \( (\varepsilon) \)
…..It helps absorb the energy and re-radiate back to LOAD

\[ \varepsilon = 0.5-0.7 \]

\[ \varepsilon = 0.8-0.9 \]

W/O Coating

With Coating

Radiation
Heat flux from heat source

Absorbed & Re-radiated
Heat flux from Emisspro

Wall loss

e.g.
Fluid in coils
Steel
Ceramics
Application process

01 Refractory Installation or Maintenance

02 Surface Preparation & Coil Protection
Application process

03 Coating Work

04 Completed Work

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Measurement has an important role both in product development and verification.

"If you can't measure it, you can't improve it."

Peter Drucker
Product features

- High absorptivity & emissivity
- Good adhesion
- Good thermal strength & Thermal shock resistance
- Good chemical & Abrasion resistance
- Eco-friendly
- Simply operation
Emissivity Measurement is key for Product improvement

SCG Collaborates with NIMT for correct “Emissivity” (ε) measurement

ε = 0.5-0.7

ε = 0.8-0.9

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*Photo:www.shimansu.com
Measurement of adhesiveness: Our key competitiveness

Surface strength

Scratch parameters:
- Linear Scratch
- Type: Progressive
- Begin Load (N): 0.9
- End Load (N): 60
- Loading rate (N/min): 120

Graph showing frictional and normal forces.

Bar graph comparing surface strength:
- Uncoated: 0.9
- Coated: 38.0

Brick No. 28

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Superior adhesiveness of Emisspro® results in better performance and longer service life.

Competitor A

Emisspro®

3 Months

6 Months

3 Years

3 Years
Success Story: Ethylene Plants

Capacity: 1,200,000 ton/Year
Average saving: 4.1%
Fuel gas saving: 15,700 Ton/Year
GHG reduction: 43,000 Ton CO2/Year

Capacity: 1,700,000 ton/Year
Average saving: 3.1%
Fuel gas saving: 13,800 Ton/Year
GHG reduction: 38,000 Ton CO2/Year
## Thermo-graphical Analysis: Ethylene Plant

### Before Coating

### After Coating

20 °C Decreased

<table>
<thead>
<tr>
<th>Position</th>
<th>Casing Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Coating</td>
</tr>
<tr>
<td></td>
<td>1st</td>
</tr>
<tr>
<td>1</td>
<td>97.1</td>
</tr>
<tr>
<td>2</td>
<td>93.8</td>
</tr>
<tr>
<td>3</td>
<td>86.3</td>
</tr>
<tr>
<td>Sub-AVE</td>
<td>92.4</td>
</tr>
<tr>
<td>Overall AVE</td>
<td>89.6</td>
</tr>
</tbody>
</table>
Success Story: Steel reheating furnace

Capacity: 400,000 Ton/Year
Average saving: 6.5%
Fuel gas saving: 600 Ton/Year
GHG reduction: 1,650 Ton CO2/Year
**Application results: Energy distribution**
*(of a steel reheating furnace)*

<table>
<thead>
<tr>
<th>Segment</th>
<th>Before coating</th>
<th>After coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billet heating</td>
<td>43.6 %</td>
<td>49.6 %</td>
</tr>
<tr>
<td>Exhaust gas loss</td>
<td>40.2 %</td>
<td>34.0 %</td>
</tr>
<tr>
<td>Wall loss</td>
<td>5.6 %</td>
<td>4.5 %</td>
</tr>
<tr>
<td>Cooling loss</td>
<td>9.2 %</td>
<td>8.2 %</td>
</tr>
<tr>
<td>Scale</td>
<td>0.3 %</td>
<td>0.4 %</td>
</tr>
<tr>
<td>Other</td>
<td>1.1 %</td>
<td>3.3 %</td>
</tr>
</tbody>
</table>
Success Story: Ceramic tile kilns

Capacity: 20,000,000 M²/Year

Average saving: 4.3%

Fuel gas saving: 525 Ton/Year

GHG reduction: 1,450 Ton CO₂/Year
Certification & Awards

• SCG Eco-Value Product

• Best of Innovative Products, Idea Plus Contest 2009

• Best of Innovative Services and Non-Manufacturing Processes, Idea Plus Contest 2013

• Energy Innovation, Thailand Energy Awards 2014
Thank You for your attention

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