

CONFIDENTIAL

GreenCoat – Saving Technology

GreenEco offers innovative technology for industrial heating devices, significantly improving the efficiency of production processes. **GreenCoat** coating systems are ceramic materials with high emissivity and re-emissivity of thermal radiation, developed especially for industrial heating devices operating in the temperature range up to 1650°C. Our high emission coatings ensure increased heat transfer, energy savings, increased production, reduced downtime, increased material durability and lower emissions to the atmosphere.

GreenCoat features include:

- ✓ Thermal Stability – up to 1 650°C
- ✓ Thermal Shock resistance
- ✓ Excellent bond strength over 350 Bar
- ✓ Applied Thickness – within a 50 to 100µm range, subject to specific application conditions
- ✓ Emissivity – within 0.85 and 0.95

GreenCoat coatings can be applied at the production stage in a workshop or on-site at facilities during planned operational stoppages, on existing refractory materials and metallic surfaces. Radiation and convection energy from burners and hot gases is absorbed by the surface of the **GreenCoat** coating and then evenly re-radiated throughout the device, creating an even temperature distribution.

SELECTED INDUSTRIAL APPLICATIONS

A. Oil and Gas

Applications:

- Fired Heaters
- Primary and Secondary Reformers
- Cracker Furnaces
- Sulfur Recovery Units (SRU)
- Waste Incinerators
- Thermal Oxidation Units
- Burners
- Flares
- Radiant tubes

Major Benefits:

- Improved Heat Transfer
- Increased Run Time
- Reduced Coking
- Uniform Temperature Distribution
- Reduced Fuel Usage
- Higher Feed Rate Potential
- Reduce Carbon Emissions

B. STEEL INDUSTRY

- Reheat Furnaces
- Electric Arc Furnaces (EAF)
- Annealing Furnaces – Continuous/Batch/Bell/Top Hat
- Crucible Furnaces
- Ladle Preheaters
- DRI Plants
- Radiant Tubes
- Roller Bars

GreenCoat benefits:

- Even temperature distribution
- Reduced heating times
- Reduced substrate temperature – reduced heat losses in refractories
- Extended life of refractories
- Reduced downtimes
- Increased energy efficiency
- Improved overall process efficiency => increased productivity
- Extended equipment life
- Eliminates dusting from refractories
- Resistant to gases, oils, thinners and most of the acids

C. TUNNEL KILNS

In the brick and ceramics industries, fuel cost is a major component of operations cost.

By using **GreenCoat** high emissivity ceramic coating, operators of tunnel kilns can reduce operating costs. Using the coatings on tunnel kiln refractories will also provide increased productivity, even heating of load and longer refractory life.

Without the coating, in tunnel kilns, insulating refractories are placed at the cold face of dense refractories in order to reduce heat loss. In this arrangement, however, refractory materials need to withstand higher temperatures as a significant amount of heat gets stored in refractories.

What's more, valuable energy is lost as the working lining acts as a heat sink during cyclical operation

GreenCoat coatings are applied to the hot face of the tunnel kiln. The heat energy radiated from the burners is absorbed by the high emissivity coating and re-radiated back to the cooler load in the kiln.

The thermal energy absorbed by the coating is re-radiated and absorbed by the colder load. The refractory lining is subsequently cooler and retains less heat energy.

GreenCoat application in tunnel kilns

Emissivity of typical refractories is within a range of 0.3 to 0.5. **GreenCoat** application increases it to ~ 0.9. An increase in the emissivity of the refractory results in an increase in the heat energy absorbed by the production piece. This may result in over-firing that can affect the properties of the product that is being fired. The burners need to be turned down, leading to a significant fuel consumption reduction. Alternatively, processing speed may be increased leading to a higher output.

GreenCoat high emissivity coatings absorb and re-radiate maximum heat energy when the temperature gradient between the kiln load and the coating is maximum. Therefore, **GreenCoat** is applied only in preheat and soak zones in tunnel kilns. In the cooling zone of tunnel kilns, the temperature of the product is higher than that of the refractory and so coating is not applied to this area.

GreenCoat coatings are characterized by very good adhesion to the surface of all ceramic refractories, both dense and ceramic fibers. The coating can be applied even when the substrate is worn or corroded.

Proper surface preparation is a required for obtaining a proper bonding of the coating. The surface must be free of dirt and oil. It cannot be covered with any other coatings or dust.

GreenCoat is applied by qualified employees with the use of specialized equipment. Assuming that the substrate is in good condition and does not require extensive preparation (grit blasting), the whole process of applying the coating can be completed in one day. Under typical atmospheric conditions, the **GreenCoat** coating dries in approx. 24 hours; after that the kiln can be started.

The most important benefits for tunnel kilns resulting from the **GreenCoat high emission coatings application.**

Increased process efficiency can be achieved through the effective use of insulation in tunnel kilns. The main advantage of using **GreenCoat** coatings in tunnel kilns is fuel economy resulting from lower burners' operating parameters. Savings in fuel within a range of 3 – 20 % have been reported, depending on the design and operation of the furnaces. Alternatively, by using the extra available energy, the process speed of the furnace can be increased, improving productivity.

Because of the **GreenCoat** coating application to the refractory liners, heating becomes more homogeneous, increasing the efficiency. Another benefit is that the refractory materials remain cooler and undergoes less thermal shock and stress. As a result, it is expected that operational life of refractories will be extended.