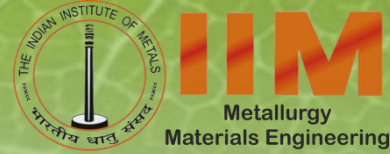


**TATA STEEL**

 WeAlsoMakeTomorrow



*Presents*

International Conference on  
**GREEN & SUSTAINABLE IRON  
MAKING**

January 17 – 18, 2024





# Presentation

On

**Design and Synthesis of Hydrogen Donor Polymers for Steel Making: Use cases in Coke Making & Beyond**

**(17<sup>th</sup> January - ICGSI 2024 )**



## Chairman's Speech

Celebrating innovation at Sreechem Resins Limited, we're committed to sustainable chemistry for a brighter future. Our focus: delivering high-quality products, nurturing a skilled workforce, and minimizing environmental impact. We value our stakeholders' trust, striving for excellence in every endeavor. Together, we're crafting a sustainable, prosperous tomorrow.



**Binod Sharma**

Managing Director, SreeChem Resins Limited



# About us



**45+**

Products



**60+**

Indian Customers



**2+**

Manufacturing Plants



**100+**

Employees



- 1 State of the art manufacturing facility** – Spread across 36000 sq. mtrs
- 2 R&D focused organization** – 1 Patent Granted, 2 patent applications filed
- 3 Focus on Innovation** – 7 Trademark applications filed in 2023
- 4 Product pipeline focused on decarbonization, sustainability**

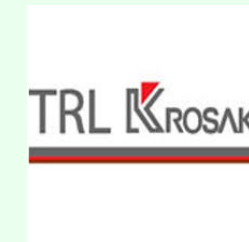


# Existing Product Portfolio

## Product Portfolio

Area	Products
Refractory Resins	<ul style="list-style-type: none"> <li>• <b>Shell Resins for Indian Railways (Wheel &amp; Axle Plant)</b></li> <li>• Resins for Magnesia Carbon / CC Refractories</li> <li>• Resin for Slide Plates, Impregnation Resin for Flow Control Refractories</li> <li>• Resin for Silica Refractories</li> <li>• Resin &amp; Green Binders for Burnt Alumina</li> <li>• Binders for Monolithic Refractories</li> <li>• <b>Resin for Taphole Clay Mass</b></li> <li>• Resin for Dolomite</li> <li>• Solvents &amp; Catalysts</li> </ul>
Industrial Coatings	<ul style="list-style-type: none"> <li>• C-3/C-6 class coatings for electrical steel</li> <li>• <b>Zero VOC water based Corrosion Coatings (UC-555)</b></li> <li>• Red / Black Oxide PU Grade &amp; other Industrial Paints</li> </ul>
Waterproofing Chemicals & Coatings	<ul style="list-style-type: none"> <li>• Integral Water proofing compounds (C-MAX)</li> <li>• Latex based coatings for waterproofing (SEELANSHIELD)</li> <li>• Premium Water Emulsion</li> <li>• <b>Heat reflective coatings (CRYOCOTE)</b></li> <li>• Top Coat (PU Based clear coat)</li> </ul>
Specialty Chemicals	<ul style="list-style-type: none"> <li>• <b>Polymer for Coke Making</b></li> <li>• <b>Specialty additives for Coke Making</b></li> <li>• <b>ULP Binder for Ferro Alloys</b></li> </ul>

## Our Esteemed Customer(s)





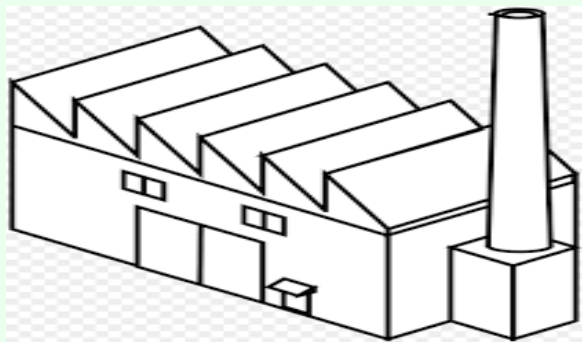
## CONCEPT – I

**Design of polymers which are able to generate Hydrogen ( $H_2$ ) in the plastic zone while co-pyrolyzing with coal to improve the coking potential of non-coking coals.**



# Case Study on Success Story : Organic Polymer (NR-40) - An Overview (Joint Patent held by SRL and TSL)

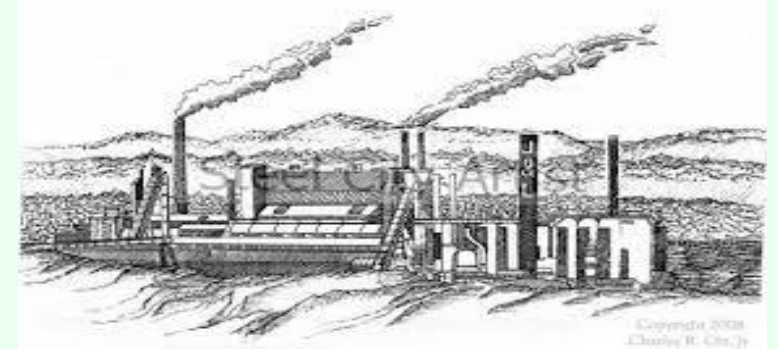
- 1 Project Initiated in the year 2016 under TSL R&D to utilize PCI/Weak/Thermal Coals in Coke Making
- 2 Multiple product iterations and continuous feedback from R&D to establish the formulation of polymer
- 3 **First Bulk Trials in February 2019**
- 4 **Approx. 35000 MT of Organic Polymer NR-40 has been supplied** in different TSL plant locations
- 5 **Polymer has been used in more than 5 Million Tonnes of Coal** till now



Manufacturing at Sreechem Resins  
Unit-2 (Raigarh)



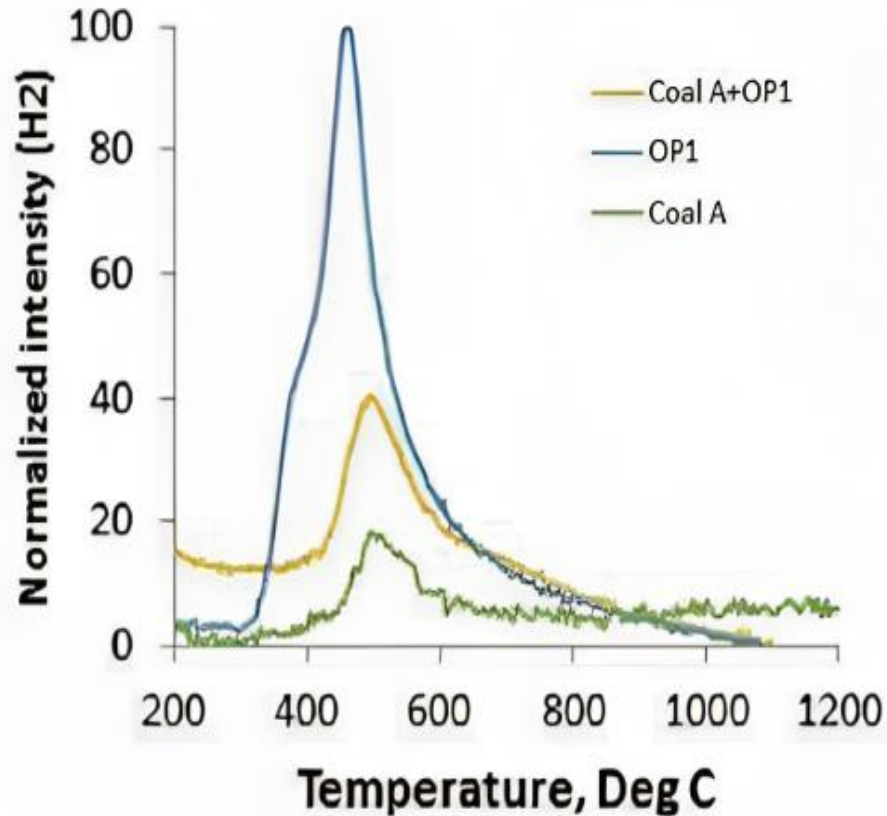
Transportation in Bulk  
Chemicals Tankers



Use in Coke Ovens at Tata Steel



# Organic Polymer (NR-40) – Working Principle



- As the reserve of prime coking coal is low, there is a good amount of research going on worldwide to improve the coking potential of non-coking coal.
- Researchers have revealed the importance of **hydrogen generation/transfer** to improve the coking potential of coal.
- Coking potential** has been tested through conventional tests like **crucible swelling number (CSN)**. Thermogravimetric mass spectroscopy (**TG-MS**) has been used to get an idea of plasticity and **hydrogen generation in the plastic zone**. High-temperature microscopy has also been used to evaluate the swelling of coal.
- Results indicate that the **addition of polymers** in small percentage has an **effect on hydrogen generation in the plastic zone**, and thus, it can improve the coking potential of non-coking coal.





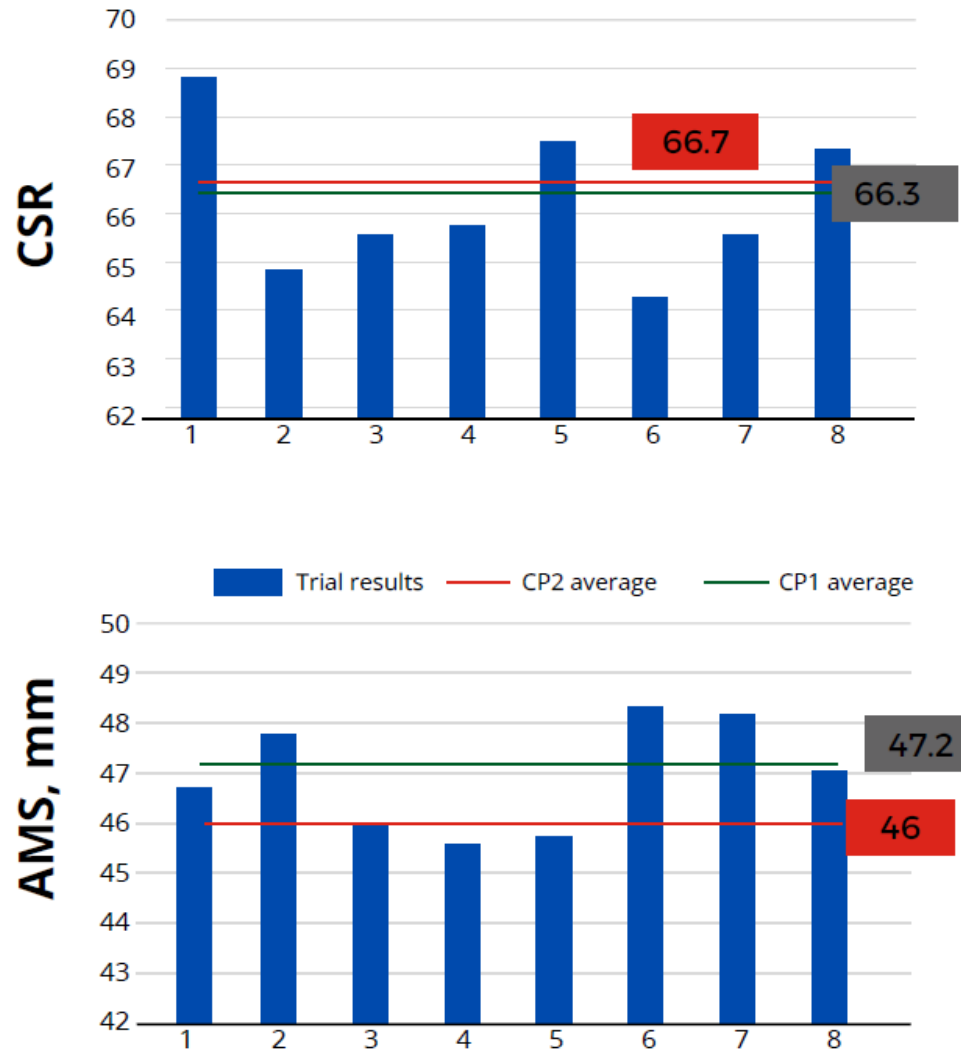
# Organic Polymer Usage in Coke Ovens – Animation



Note: The polymer usage has been established in Stamp Charge Coke Ovens. Trials are ongoing in Top Charge ovens. For a visually simpler animation top charge oven has been shown.



# Polymer Usage – Advantages



- a Reduction in Prime Coking Coal Usage:** Allows up to 10% replacement of PHCC with weaker coals. Thus the coal blend can be made leaner with polymer usage.
- b Maintains Coke Quality:** Trials have shown that even with the leaner blend the baseline CSR and AMS numbers are being sustained.
- c Economic Efficiency:** The objective of using the polymer is to reduce the blend cost while sustaining the baseline quality parameters. Hence, the delta is measurable and favourably impacts the bottom line of the company using the polymer blend.
- d Environmental Impact:** Potential reduction in the carbon footprint by utilizing lower-quality coal resources more efficiently.
- e Proven, Tested and Scalable:** Successfully used in more than 5 million tonnes of coal in coke ovens ensuring reliability and effectiveness.





# Organic Polymer Journey – In Pictures





# Polymer Unloading, Storage and Dosing Setup





# Polymer Dosing Trial Setup – Simple, Uncomplicated





# Product Pipeline for Coke Ovens

SL	Theme	Product Name	Description	Stamp Charge	Top Charge
1	PHCC Reduction (Leaner Blend)	NR-40 / NR-40(M) (Organic Polymer)	Proven product with a PHCC replacement ratio of up to 12% depending on the base blend. Used in more than 5 million tonnes of Coal in different TSL Plants.		
2		SR-303(M) (Modified Organic Polymer)	Organic Polymer blend with substitutions to achieve PHCC replacement ratio of up to 11%. It has been newly developed as a lower cost direct substitute of Organic Polymer NR-40. Bulk trials conducted in TSLPL, Gamharia. Trials in pipeline in TSJ, HMC.		
3		nCARB-2025	A low cost nano carbon based additive for reduction of PHCC with Weaker/PCI/Thermal Coals in the coal blend. It has the potential to achieve PHCC replacement ratio of up to 11%. Trial samples submitted in TSL R&D.		
4	BD IMPROVEMENT	SRTC -11	Increases BD by 3-5%, improves productivity and also impacts CSR favorably. Possibility to reduce moisture while maintaining the coal cake stability by using the additive is also being explored.		



# Product Pipeline for Coke Ovens (Contd..)

SL	Theme	Product Name	Description	Stamp Charge	Top Charge
5	CSR	RR-4	Improves CSR. Is very effective with blends having only 3-4 coals. Improvement in CSR by up to 5-7 points has been achieved with single coal trials.	✓	!
6	Moisture Removal	MRP - 10	Moisture removing polymer (MRP) for reducing coke moisture by approx. 2.5%. High coke moisture leads to higher coke rate in the BF	✓	✓
7	Productivity	PE-10	Productivity Enhancement – Coking Time Reduction	✓	✓
8		PE-20	Productivity Enhancement – Coking Time Reduction (Better dispersion due to higher addition percentage 0.2%)	✓	✓
9	AMS Improver	Inmisol-20(P)	Improves the Arithmetic Mean Size (AMS) of coke	✓	!
10	M40 & M10 Preservation during In-Plant handling	Tough Coat – 2P	It is a custom designed 2 component coating system which preserves the M40 and M10 percentages of the coke produced by reducing the breakages and fines generation which happens during the in plant and inter plant transportation.	✓	✓



## CONCEPT – II

# Coatings and Additives for Modifying the CRI of Coke and its Impact on Blast Furnace Productivity





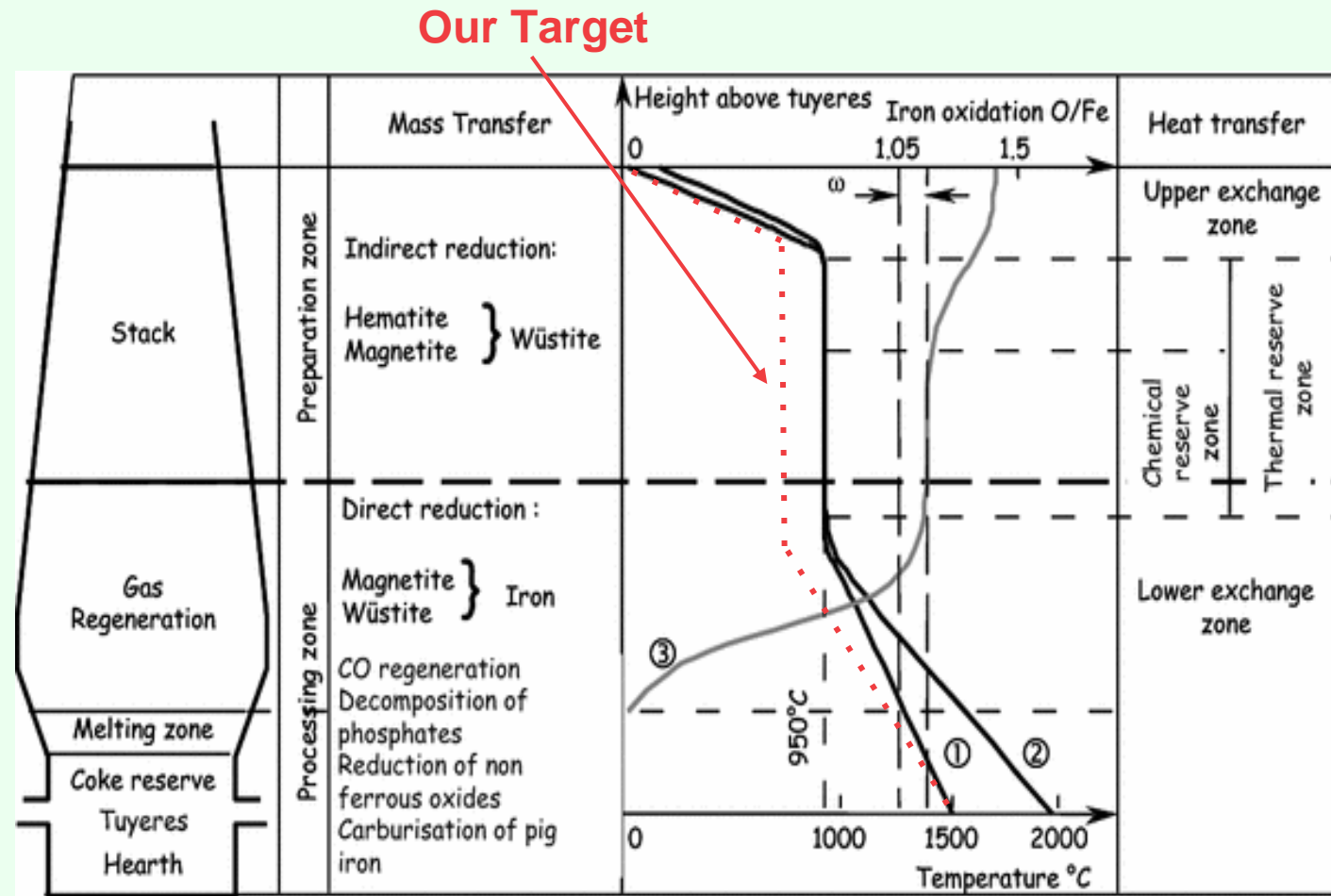
# Enhancing Blast Furnace Efficiency with "CRI Max" Coke Coating Polymer

We are working on our innovative "CRI max" coke coating polymer. It's an innovative coke coating polymer designed to enhance the reactivity of nut coke used in blast furnaces. It's formulated to lower the Thermal Reserve Zone (TRZ) temperature in the furnace from 1100°C to 900°C, thereby increasing the reaction efficiency.

The application of "CRI Max" involves coating nut coke through methods like spraying, ensuring even coverage and optimal performance. This technology represents a significant advancement in the field of metallurgical engineering, promising **both efficiency improvements** and **environmental sustainability** in steel production.

## Benefits of "CRI Max"

- **Increased Coke Reactivity:** Amplifies the reactivity of coke, ensuring a faster and more complete reaction.
- **Reduced CO<sub>2</sub> Emissions:** Contributes to a greener manufacturing process by reducing carbon emissions.
- **Cost Savings:** Lowers overall operational costs through reduced coke consumption and increased furnace longevity.





# **An Overview of our other Major Initiatives Towards Decarbonization and Sustainability**



Attempting to **address the persistent issue of Red Mud** which is a generated by the alumina industry.



New generation **water based anti corrosion coating** which is **VOC Free** and gives **400 Micron DFT** (Dry Film Thickness)



The **ceramic microsphere technology** in **Cryocote™** helps us in keeping buildings cooler and **reduces your carbon footprint.**





# Sreechem Innovations – Product Pipeline (Page 2/3)



Our **best in class water proofing** solutions. **We don't just claim, we deliver results.**



Product developed for **Rail Wheel Factory** (Indian Railways) and in use for 25+ years. **Substituted the imported PF Resin Flakes.**



The mainstay of Sreechem Innovations. Our solutions are **process friendly, scalable and measurable. 1 Patent granted** and 2 more under pipeline.



Our sister concern Worth of Waste (WOW) Concepts is making **carbon neutral building products** using the Geopolymer Technology



First **ULP (Ultra Low Phosphorous) Binder** for application in Chrome ore Briquetting for the Ferro Chrome Industry in India.



Odozorb™ - Use of **Charged Ceramics** for removal of odours.



# The Carbon Neutral Blocks/Bricks/Concrete (70–100% reduction in carbon footprint)

- 1 Projects in the name of Worth of Waste Concepts Pvt Ltd with Brand name “WOW Worth of Waste” (Trademark Registered)
- 2 Objective is to create cost competitive products out of industrial wastes (Environment Friendly without subsidy)
- 3 Flexible, Adaptable binder design for getting the desired strength (M10 to M40) for different applications





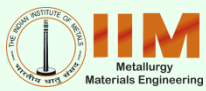
# Bamboo Reinforced Geopolymer Concrete Road





# PAC (Polymer Activated Concrete) Technology Demo Plant set up in Raigarh (C.G.) – 1 Lac Bricks Per Day

**TATA STEEL**  
WeAlsoMakeTomorrow



**Industrial wastes as Raw Materials**  
**+**  
**Proprietary Binder System**

**=**

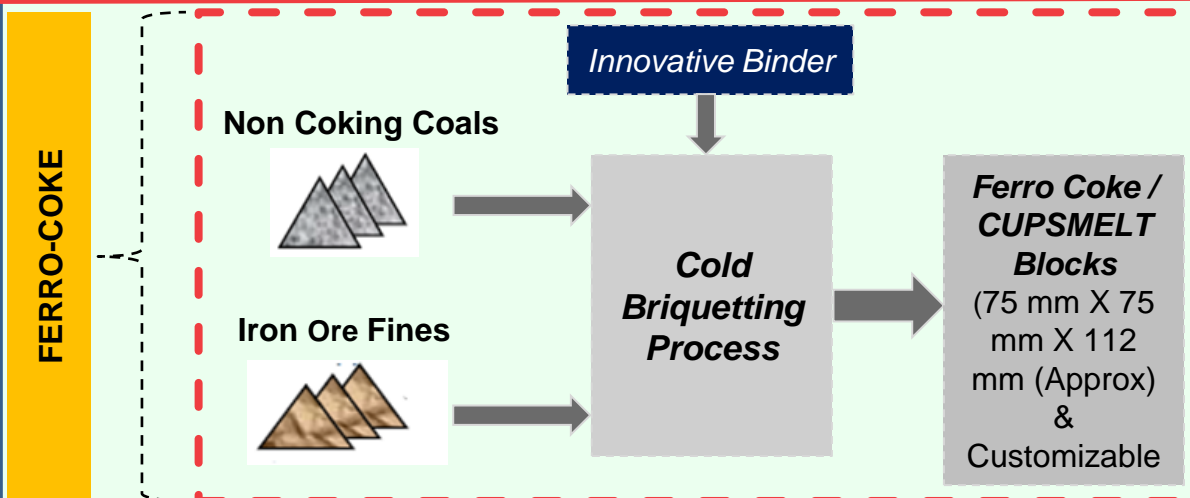


Worth of Waste





# AGGLOMERATION CASE STUDY : Utilization of Low Grade/Waste Fines

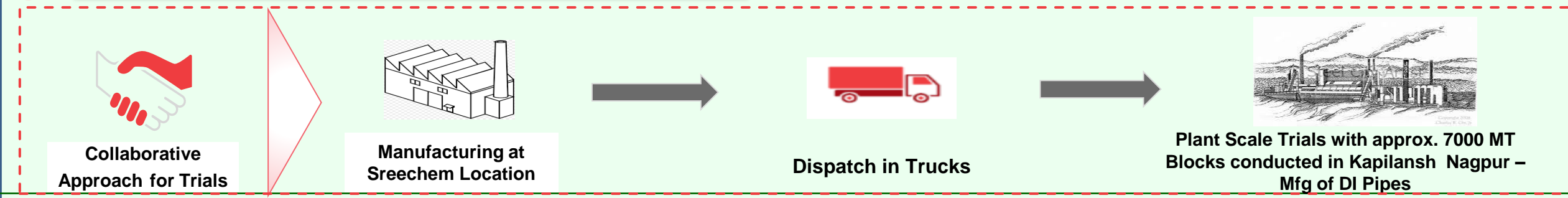


## Chemistry of Ferro Coke / Cupsmelt Blocks (Per MT)

Description	Quantity (In Kgs)	Remarks
Iron ore in form of Fe <sub>2</sub> O <sub>3</sub> & other metaliks	670	Fe(T) - 44 ± 2 %
Carbon in form of coke & coal combination	200	
Fluxes, Binder & Chemicals	130	
<b>TOTAL</b>	<b>1000</b>	
<b>Block Size (in mm)</b>	75 mm X 75 mm X 112 mm (Approx.) - Customizable	

### ADVANTAGES

- Utilization of Low Grade** : Iron Ore, Slimes and Coal in BF
- Cost Reduction** : Low cost RM being used in the BF





# Environment Friendly Anti-Corrosion Coating: Zero VOC, Water Based

UNIVERSAL COATING

UNIVERSAL COATING

UNIVERSAL COATING

TESTED & APPROVED BY NATIONAL TEST HOUSE GOVERNMENT OF INDIA

Coating thickness

1 Coat  
150 to 200 micron

2 coats  
350 to 400 micron

# UNICOAT-555

ADVANCED PROTECTION + SIMPLIFIED APPLICATIONS

On MS plates, the coating creates a defensive layer that resists rust and maintains the metal's strength and appearance.



MS Plate

Unicoat-555 forms a robust, rust-resistant layer, preserving the stainless steel's luster and durability.



Stainless Steel

The coating penetrates the porous surface of bricks, offering a protective barrier against moisture and environmental wear.



Brick

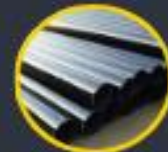
It provides a waterproof seal on concrete, protecting against cracks and water-induced damage while maintaining structural integrity.



Concrete



APPLICATION AREAS



PVC Pipes



Wood



Rebars



MS Pipes

It coats rebars with a corrosion-resistant sheath, significantly prolonging their service life in harsh environments.

The coating enhances the pipes' resistance to corrosion, ensuring safe and sustained transportation of fluids.

On wood, Unicoat-555 serves as a shielding coat, preventing water absorption and enhancing the wood's natural resilience to decay.

Unicoat-555 applies smoothly to PVC, creating a non-toxic, water-resistant exterior that extends the pipes' life.

Universal Coating

VOC Free Coating

Water Based Coating

Rust Proof

400 micron Coating



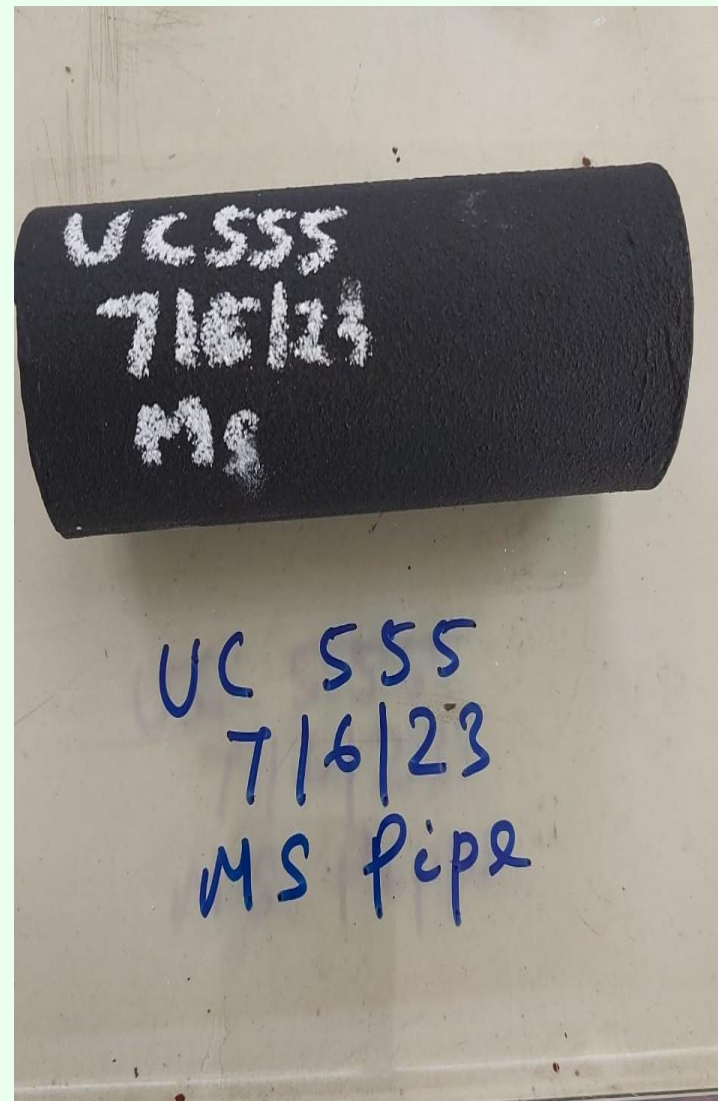
# Possibilities with the Universal Coating series (UC-555, UC 150)



Used by Kankyo Bert and exported to Japan for Installation in a Bio Gas Plant



# Possibilities with the Universal Coating series (UC-555, UC 150) (Contd..)





# CRYOCOTE™: High SRI Paint with the lowest U Value

HIGH-REFLECTIVITY

## CRYOCOTE™

CLIMATE-COOLING TECHNOLOGY

High SRI Paint for Ultimate Thermal Protection

### COMFORT ENHANCEMENT

By maintaining cooler interior temperatures, it ensures a more comfortable living and working environment, especially in hot climates.

WITHOUT CRYOCOTE™  
65-70°C



WITH CRYOCOTE™  
37-42°C

### ECO-FRIENDLY

#### ENERGY SAVINGS

Cryocote's high SRI means it reflects more sunlight and absorbs less heat. This reflection translates into cooler building interiors, which in turn reduces the need for air conditioning.



#### REDUCED COSTS

Its waterproof and thermal barrier properties minimize the need for frequent maintenance, saving time and money in the long run.



#### SUSTAINABILITY

Cryocote is formulated with sustainable materials that are non-toxic and free from hazardous chemicals.



#### REDUCING CARBON EMISSIONS

The energy savings from reduced heating and cooling needs directly translate into lower carbon emissions.



### CUSTOMIZABLE AESTHETICS

Available in various colors, Cryocote can be tailored to meet aesthetic preferences while delivering its thermal protective benefits.

### Applications

Cryocote is ideal for application in regions experiencing high temperatures and intense solar radiation.



Metal Roof



Boundary Wall



Doors



Roof



Metal Tanker



Overhead Tanks

### How To Use

- Apply the first coat of Cryocote as a primer, followed by subsequent coats for optimal effectiveness.
- Ensure a drying time of at least 60-90 minutes between each coat.
- Cryocote can be applied using standard painting tools like brushes, rollers, or sprayers.
- The paint is adjustable with universal stainers to achieve the desired color.

Cryocote exemplifies an innovative approach in the paint industry, aligning environmental stewardship with practical benefits. Its adoption not only aids in creating more sustainable buildings but also plays a critical role in the broader context of energy conservation and climate change mitigation.



# Q&A



# Thank You

**“Sustainability and profitability go hand in hand. That’s how you build a resilient company, whether you’re an incumbent or starting from scratch. The cost of doing nothing is just too high because everybody has this at the top of their agenda.”**