MESO COAT AN Abakan SUBSIDIARY

# Advanced Coating Technology for Infrastructure

Contract number **70NANB10H020**

15 March 2014

MesoCoat, Polythermics

# Overview

- Team Introduction
- Project Introduction
- Technology Overview
- Results and discussion
- Future Plans
- Summary

# Project Goals

- Develop a novel coating technology using a

  **high-intensity infrared light source**

  to fuse and bond nanocomposite metal coatings and claddings to infrastructure components
- Mitigate corrosion in infrastructure
- Reduce hazardous materials usage (heavy metals, VOCs, $Cr^{+6}$)

# Value proposition

- Faster application rate (40X)
- Improved Life (2-4X)
- Metallurgical bond
- Better cladding (smooth, pinhole free, low dilution)
- Low heat input to substrate (small HAZ)
- High corrosion resistance
- High ductility
- High resistance to mechanical damage
- Completely automatic application
- Excellent resistance to chemicals
- Lower initial cost
- Wide range of applications

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# MesoCoat, Inc.

## Advanced Materials and Specialty Metals Company:

- Develops, manufactures and markets advanced nanocomposite materials, and innovative fabricated metal products
- Fast becoming a world leader in metal protection and repair through their revolutionary **“long life” coating** and “**high speed” cladding** technologies








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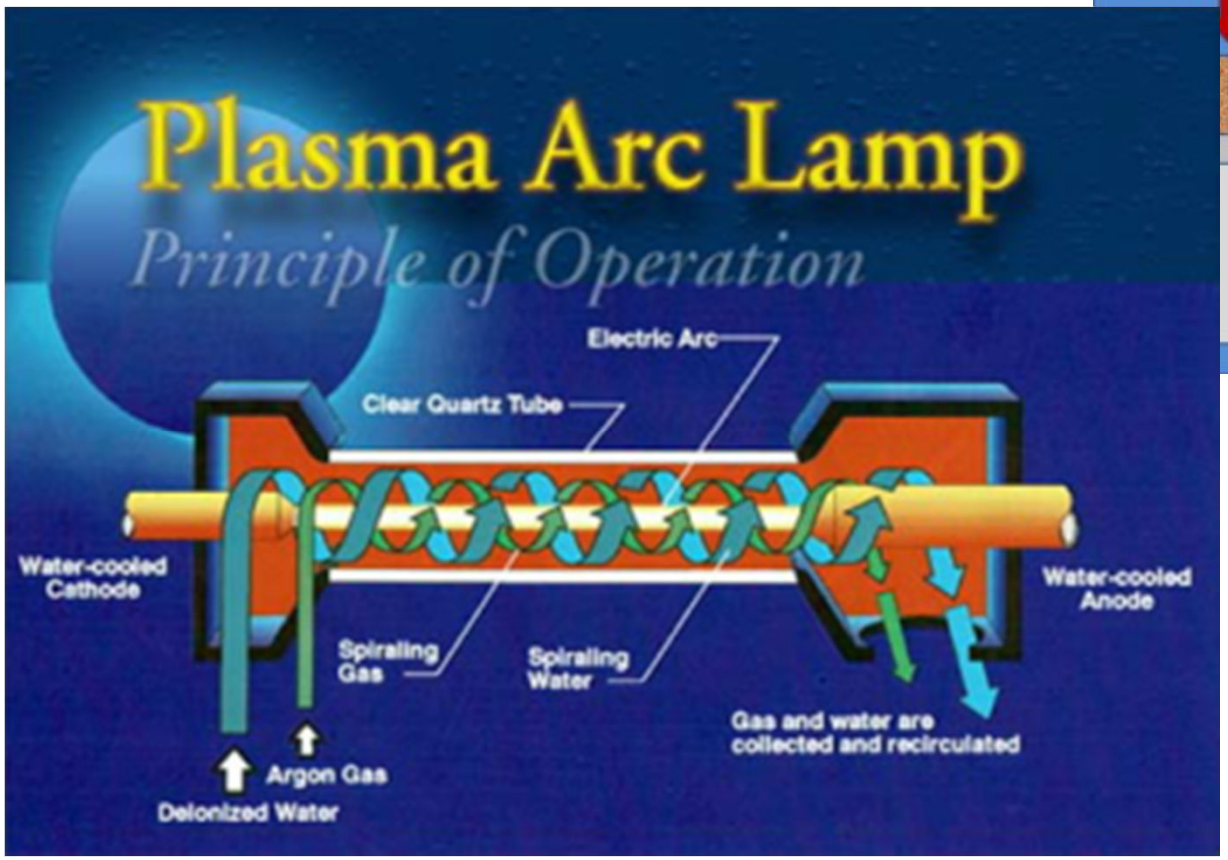
# Polythermics, LLC

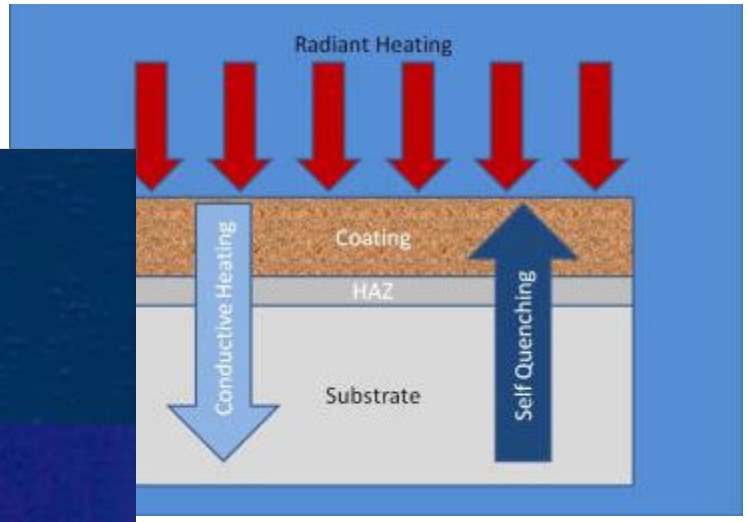
Polythermic plastic coating systems are a result of

- over 40 years of industry development and innovation.

By combining the long-term performance of polypropylene and polyethylene with the stability of an advanced thermo-epoxy, Polythermics coating systems establish a new standard for steel and polymeric concrete protection.

# Technology Review - MesoCoat

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# CermaClad™

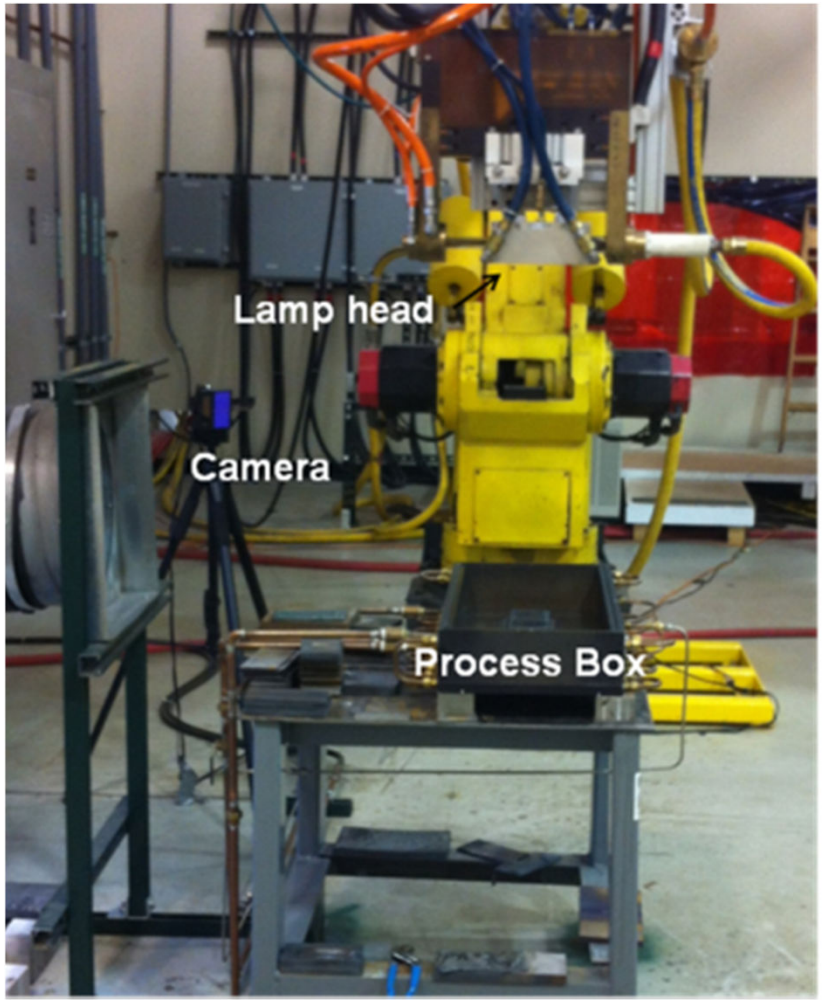
- CermaClad™ is a new weld overlay technology suitable for applying metallurgically-bonded claddings to large areas
  - MW-class thermal torch (base tool is 500KW)
  - 2000-50,000+ sq. mm spot size
  - 1-100sq m/hour, 80-500+lbs/hour deposition rate
- Original developed at Oak Ridge National Lab; Exclusively licensed to MesoCoat
- CermaClad™ is a high energy density fusion cladding process for large area applications where corrosion and/or wear limit the life of metal structures
- CermaClad™ technology utilizes a high intensity light source, which is effectively an artificial sun captured in a reflector to rapidly fuse metal and cermet coatings on steel pipes, plates and bars

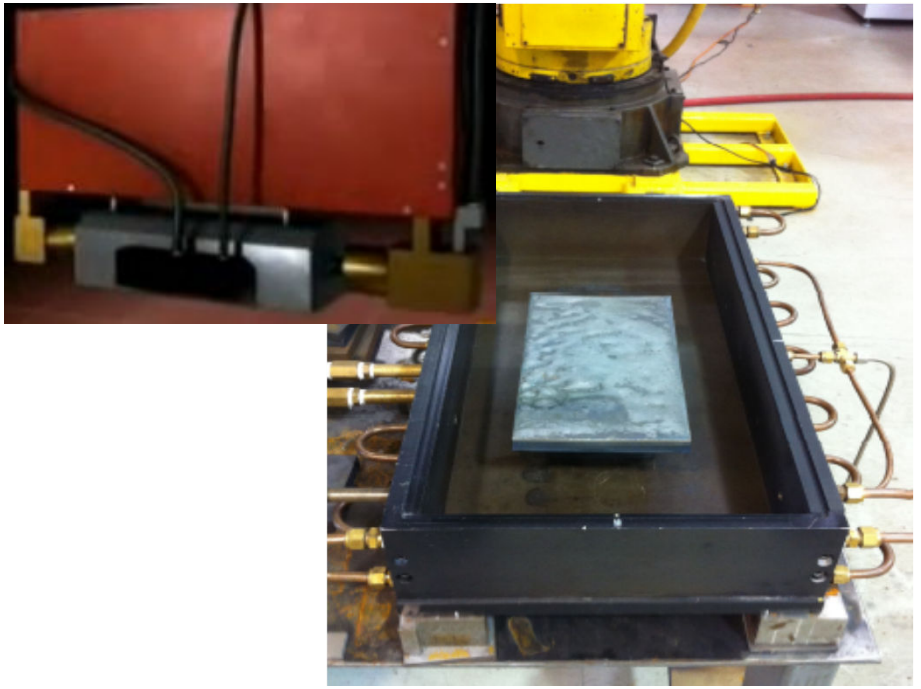
# CermaClad™


- **Beam Width:** 12 – 30 cm
- **Transition Speed:** 10 – 50 mm/sec
- **Cladded Area:** 80 – 580 sq. ft./hour

- **Beam Width :** 0.5 – 0.7 cm
- **Transition Speed:** 20 – 70 mm/sec
- **Cladded Area:** 3 – 19 sq. ft./hour

# R&D Center

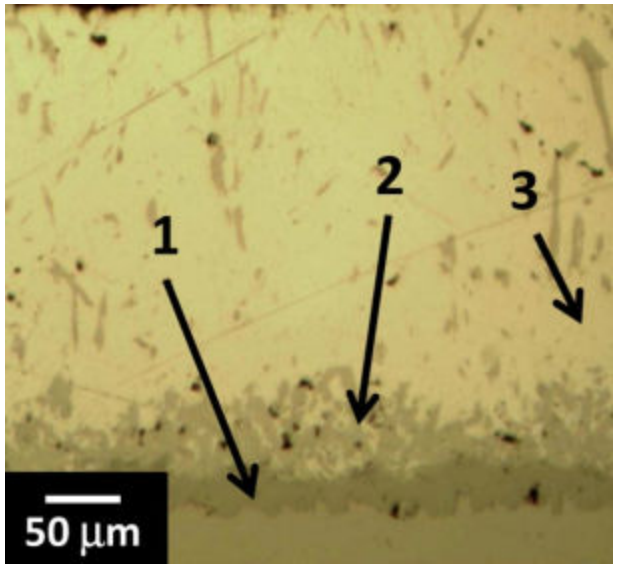


**Significance:**

This new facility has helped MesoCoat in expanding its processing capabilities and ensure faster processing to satisfy customer needs.

# Production of pinhole free Al-alloy coatings

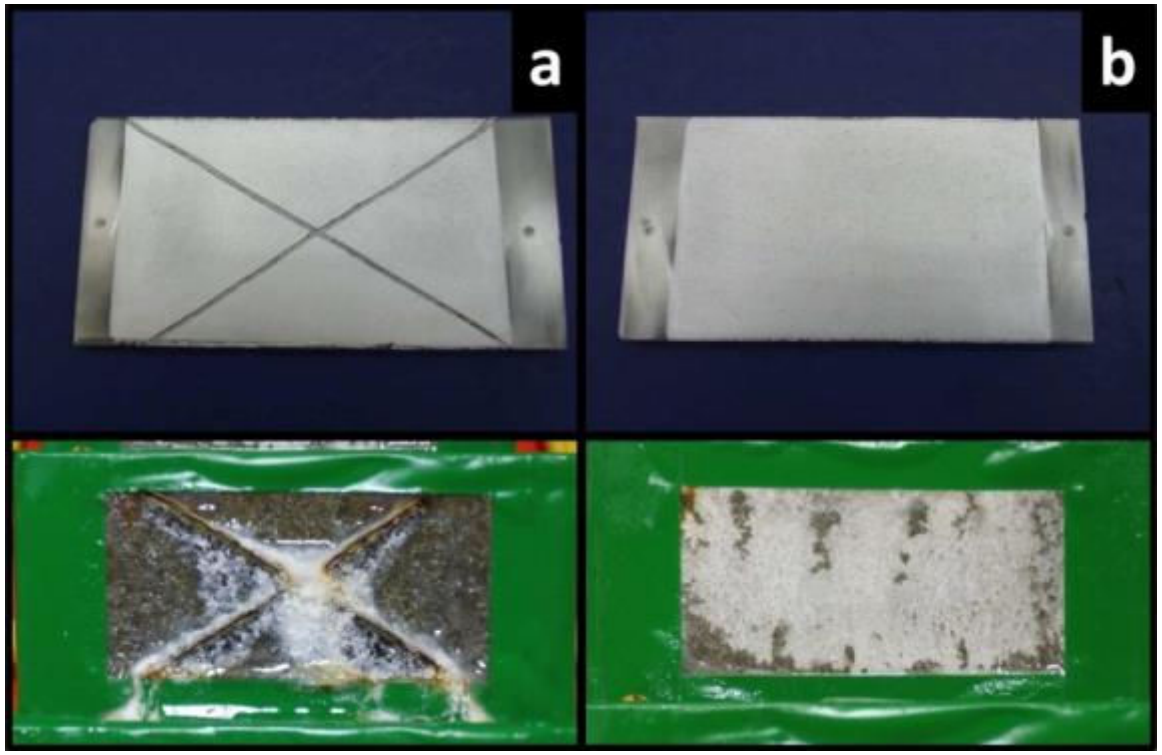



**Significance:**

Al coatings will also provide the intended corrosion resistance to eliminate the life-limiting flaws for 100 year life coatings for infrastructure applications.

# Excellent corrosion resistance of Al coated coupons





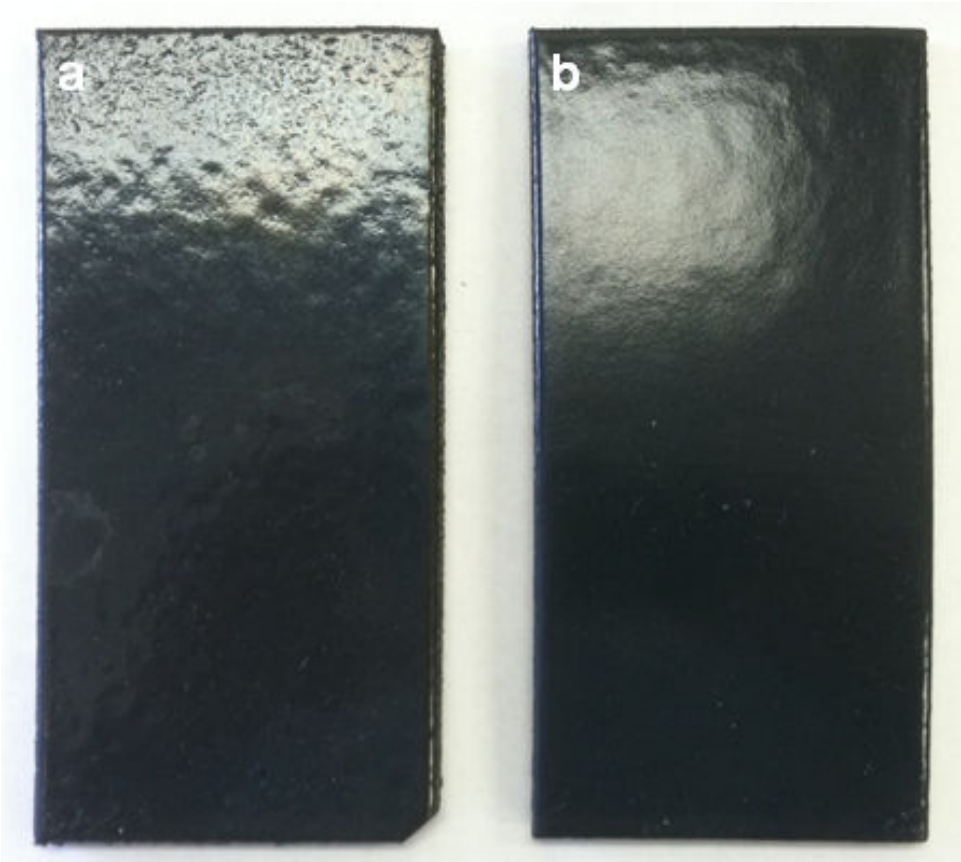

**Significance:**

1000 hours of salt fog testing verified the fact that the developed coatings are in fact able to offer the desired corrosion resistance.

# Polythermics - Thermoplastic Top Coats

- ✓ Simplified Application Procedures
- ✓ Lightweight Efficient Installation Equipment
- ✓ Advanced Coating Technology

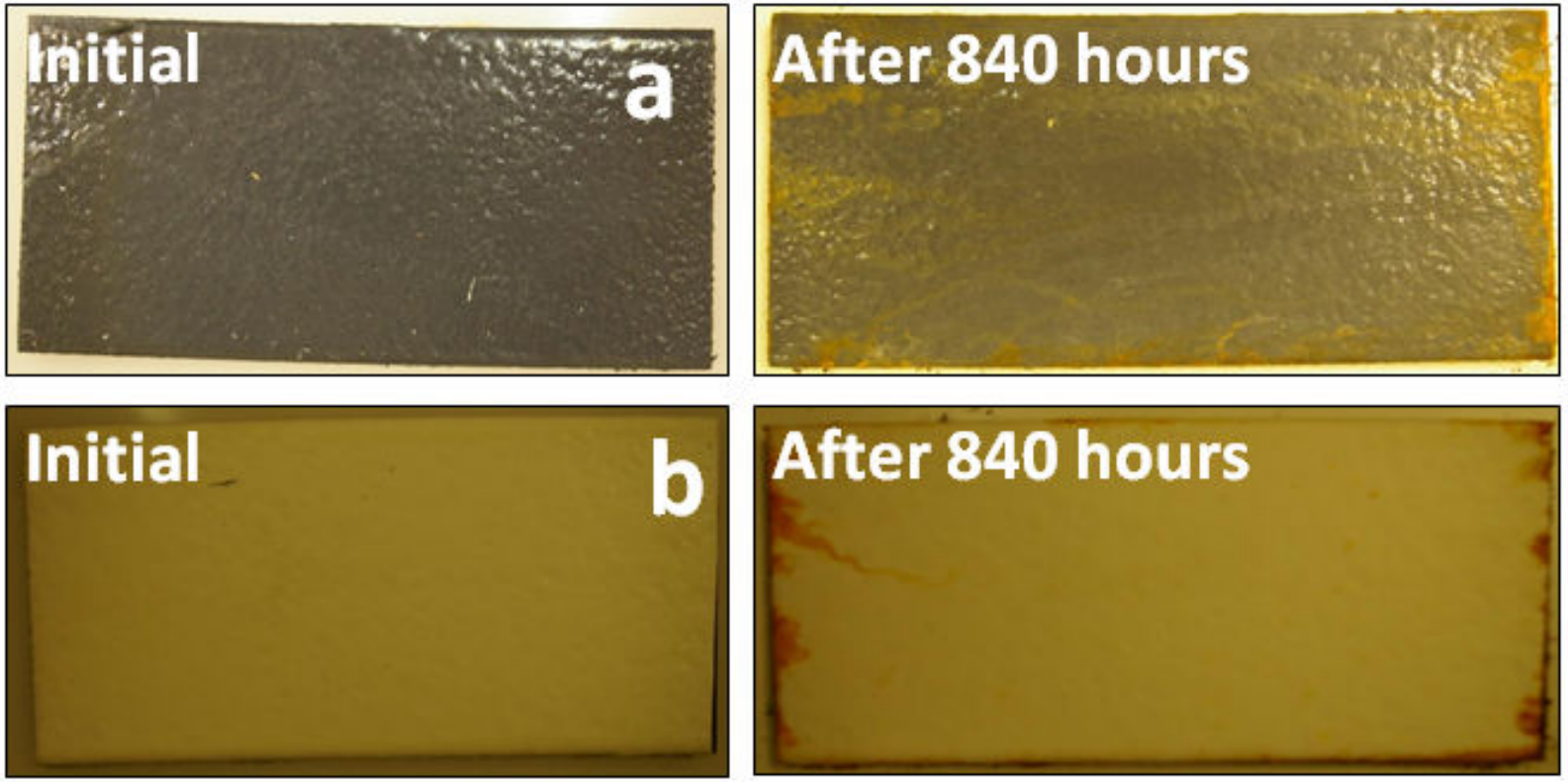
# Application of thermoplastic topcoats




**Significance:**

- A key feature of this thermally applied basecoat and topcoat technology is the extent of intermolecular bonding between the basecoat and the underlying surface (the primer coating).
- Long term resistance to debonding from permeation and corrosion undercutting and greatly enhanced.

# Thermoplastic Topcoats - Testing




Accelerated corrosion test (GM 9540P) on

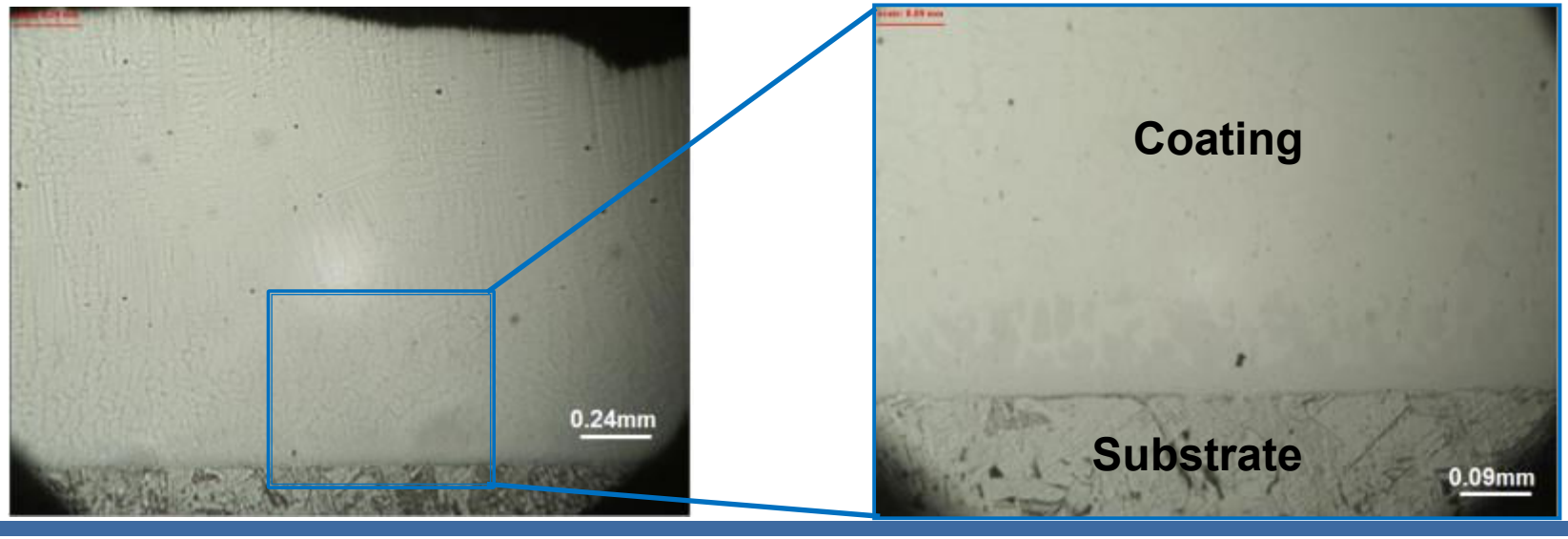
a) 1mm thick top coat of **polyethylene** on 80 µm thick Al basecoat

b) 1mm thick top coat of **polypropylene** on 80 µm thick Al basecoat

# SS316 L Coatings


- Hardness: HV(300) = 197.03 ± 11.73
- Surface of coatings is smooth

| Element (wt %) | Fe | Ni | Cr | Mn | Mo |
|---|---|---|---|---|---|
| Composition before fusion | 68.88 | 10.2 | 16.6 | 1.3 | 2.12 |
| Composition after fusion | 69.3 | 8.93 | 17.3 | 1.23 | 2.4 |

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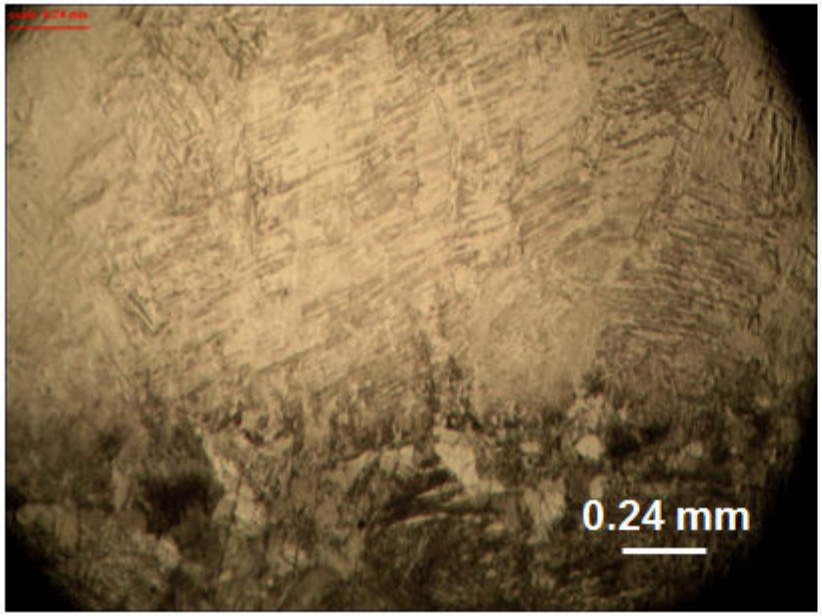
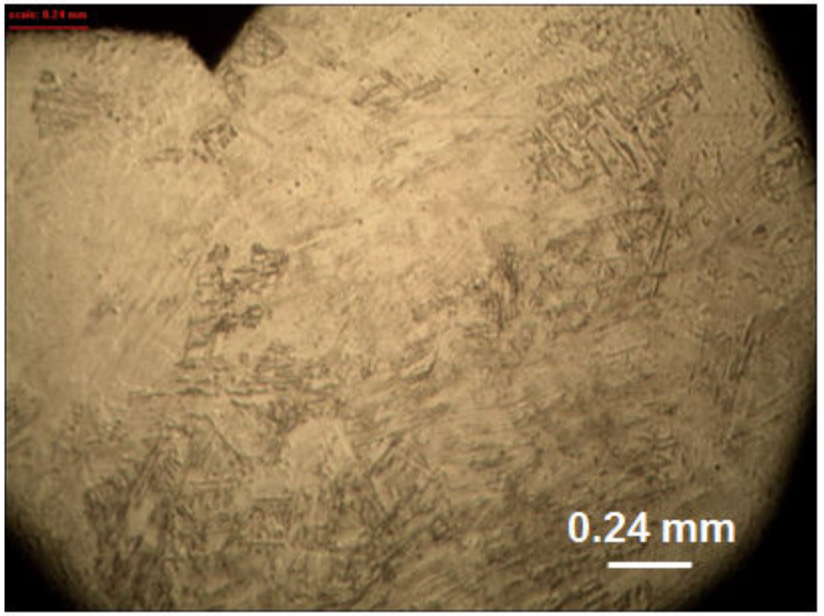
# Control Over Microstructure

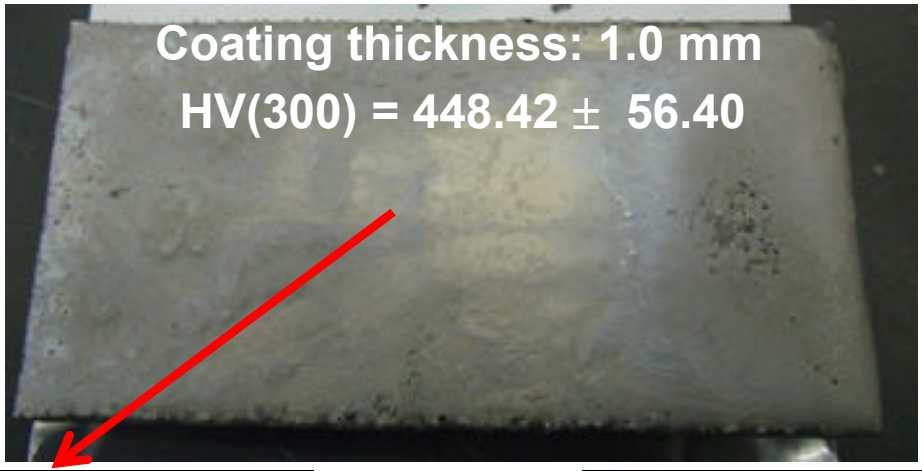


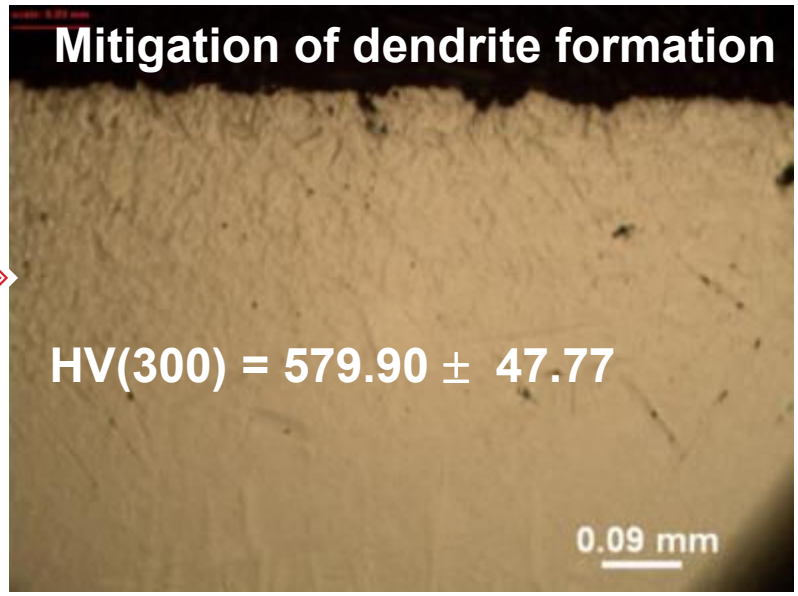

- Microstructure can be controlled by water quenching the samples after processing
- Due to water quenching, hardness (HV) was increased from 197.03 ± 11.73 to 341.09 ± 8.28
- Water quenching leads to formation of martensitic colonies.
- Martensitic steels have good corrosion resistance

# Structurally Amorphous Metal (SAM) Alloy Coatings







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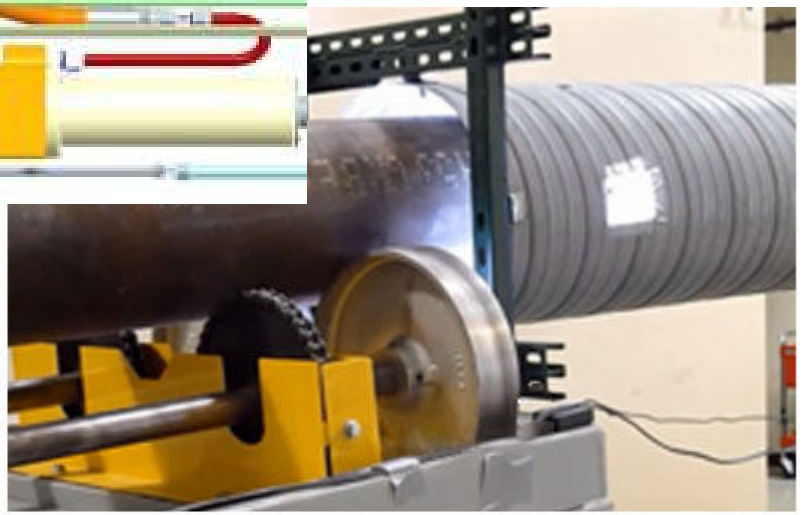
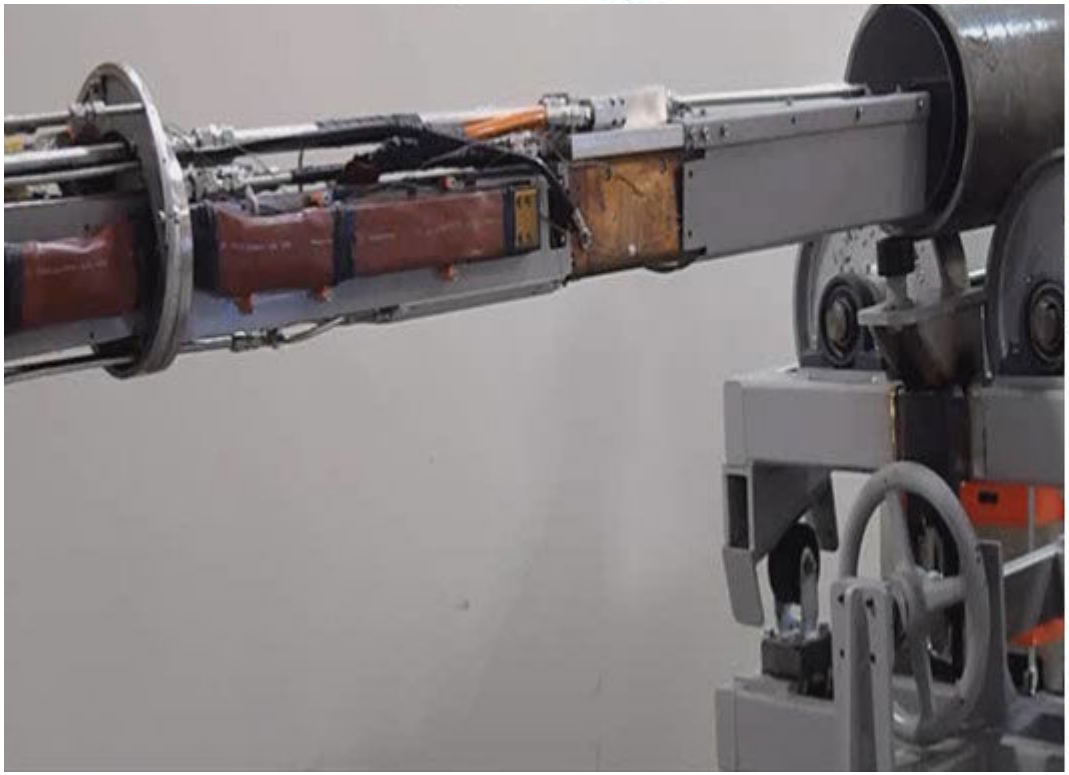
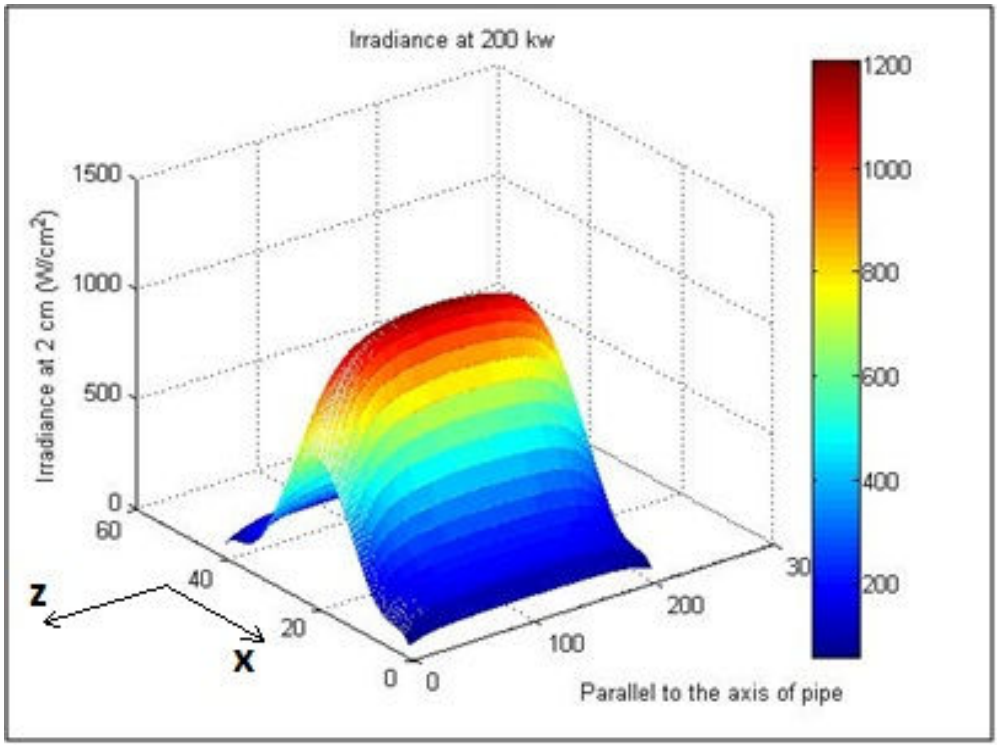
# CermaClad Design Modification



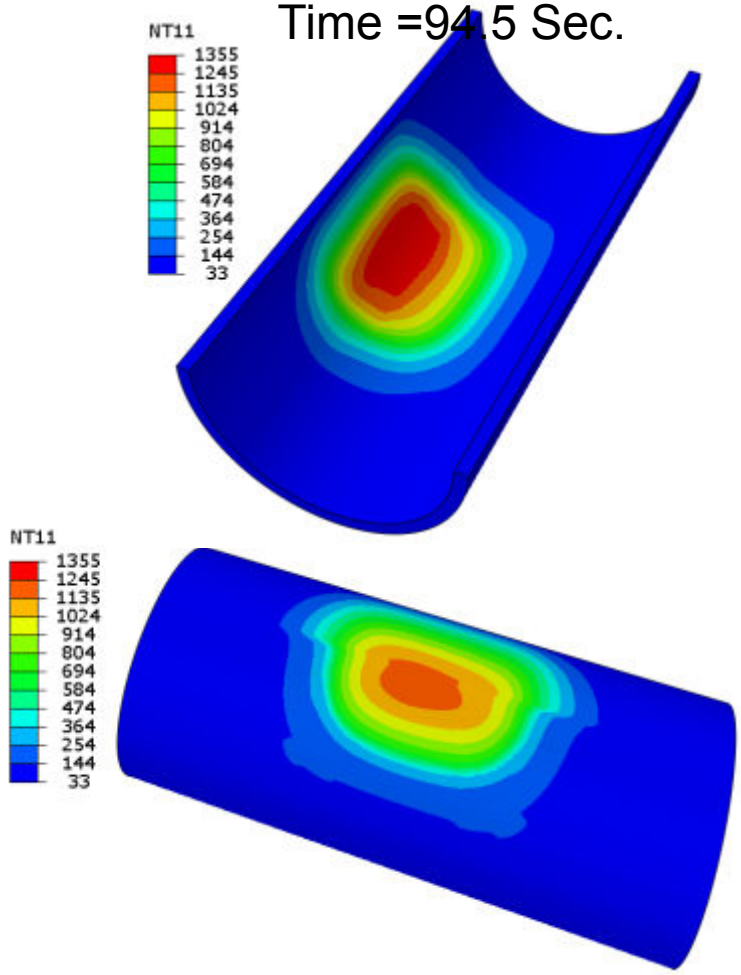


# HDIR- Thermal Modeling




Temperature distribution

Time =94.5 Sec.




Outside temperature distribution

# Infrastructure Applications





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# Technical Accomplishments

- Fusion of Al/Ni/SAM/SS316L coatings to steel substrate in air without the use of fluxes
- Defect-free coatings
- Phase control
- High corrosion resistant coatings
- Process modeling and control
- New lamp/system design

# Summary / Value proposition

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# Thank You

**Corporate Headquarter**

**Demonstration Plant**

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