

Thermal Spray Training

Sample Outline

2010



Philosophy

- Theory training in classroom
- Hands-on training in the booth

Time Schedule

- 3 days of theory
- 2 days of hands-on (two sessions)

Goals

- What are your expectations??

Outline

- General theory of Thermal Spray (TS)
 - Low velocity combustion
 - Plasma
 - Wire
 - HVOF
 - Other

Outline

Grit Blast and Cleaning Equipment

- Cleaning
 - How?
 - With what?
- What type?
 - Air pressure control
- Grit size
 - Control of grit
 - Filtering
- Surface roughness



Outline

- Plasma
 - General Overall Design
 - Create a plasma
 - Different types of gases-combinations
 - Many different gun designs
 - Control of process
 - Different types of injection
 - Powder delivery

Hands-on

System Maintenance

- HVOF Gun
- HVOF Gun Console
- Powder Feeder
- Rebuilding of gun and when to rebuild
- Rebuilding of Powder Feeder Hopper and when to rebuild
- Varied equipment/system issues that can arise
- Powder feeder issues
- Gun and Feeder Hoses and Cables
- Spark Igniter and Flame Out Detector



Outline

Process Control

- Temperature control and monitoring
- Placement and calibration of IR
- Types of assisting equipment that can be used in conjunction with spray equipment: such as “Accuraspray”.

Outline

Test Pieces

- What types of test pieces are used?
 - Tensile buttons
 - Metallography
 - Almen
 - Bend
- Any special fixtures/holders
 - Part and coupon sample preparation
 - Almen strips
 - What do they do?
 - Methods of measurements

Outline

Cooling

- What type Cooling method is used, (Shop Compressed Air, CO₂, Liquid Nitrogen)?
- Placement of cooling air or system

Outline

Masking of Parts

- Tapes/compounds/hard metal/shadow
- Are any Spray Tapes used to mask parts?
- Is Shadow Masking used?
- Is Hard Masking used?
- Is Rubber used?
- Are any Putty Type masks used?
- Current methods
 - Hard Masking (22ga – 11ga Sheet Metal)
 - Tapes
 - Mac-Block
 - Putties



Outline

HVOF History and Theory

- Why use HVOF now?
- Why are we using HVOF vs. Plasma?
 - How is it the same?
 - How is it different?
- Critical Issues with HVOF
 - Residual stress
 - Almen
 - Fatigue
- Temperature measurement
- Different types of guns/systems



Outline

Spray Booths

- What type of manipulation equipment is used, (Robot or Gantry)?
 - Turntable and traverse speed calculations
 - Degrees of freedom on robot
- Make-up air and flow
- What type of dust collectors are used?
- Are temperature measuring devices used, (Manufacturer and Model)?

Outline

Spray Equipment

- What type equipment is being used?
 - Type of console
- Gun type?
 - Special parts caps, etc
- Feeder Type?
 - Special parts hoses, etc



Outline

Spray Equipment (cont'd)

- What Type Fuel Gas is used, (Hydrogen, Natural Gas, Propane, Propylene, Ethylene, Kerosene, Argon, Helium)?
 - How is it stored?
 - Flow issues??
- What is the Carrier Gas, (Nitrogen or Argon)?
 - How is it stored?
 - Flow issues??
- Compressed air
 - How is it generated?
 - Flow issues??



Outline

Spray Equipment (cont'd)

- Is Gun hand held or machine mounted?
- Is there a Maintenance Program for the equipment?
 - Rebuild guns?
 - Rebuild powder hopper?
- Equipment calibration-flow meters



Outline

Parts that are Sprayed

- What types of parts are being sprayed?
- What are the substrates of the parts?
- What size are the parts?
- What is the geometry of the parts, (round, flat, complex shapes)?
- Do these parts hold a lot of heat?
- How are parts prepped for spray, (cleaning, masking, grit blasting)?



Hands-on

Demonstration using equipment to show different response to parameters

- Vary parameters
- Air flow
- Combustion gas
- Stoichiometric ratio
- Powder feed rate
- Spray distance
- Different powder lots and manufacturers

Hands-on

Demonstration using equipment to show

- Troubleshooting console
- Troubleshooting and rebuilding of gun
- Troubleshooting and rebuilding of powder feeder
- With a generic part, how to:
 - Clean
 - Grit blast
 - Mask
- Spraying generic part and test samples with cooling set-up



Hands-on

Part Processing Hands-on

- A proto-type part should be used during the training as a guide to demo the process of qualifying a product part using the Plasma/HVOF process.
- Use of actual dummy parts
- Grit blasting of part and coupon
- Part and coupon sample preparation
- Masking Techniques - Hard Masking, Tapes and other types of masking material that could be used.
- De-masking techniques
- Trail runs and set-ups with coupon preparation, spray, temp measurement, Almen and all lab evaluation



Schedule

- Day 1
 - Morning
 - General Lecture
 - TS Lecture
 - Afternoon
 - Grit blasting and cleaning
 - Go to shop floor
 - Q and A Session
- Day 2
 - Morning
 - Plasma
 - Plasma Lessons
 - Afternoon
 - Typical Gun Rebuild
 - Q and A Session

Schedule

- Day 3
 - Morning
 - Process Control
 - Plasma Booth Hands-on
 - Afternoon
 - Process Control Hands-on
 - Maintenance
 - Wrap-up Session

Schedule-Hands-on

- Day 4
 - Morning
 - Mask Cool
 - Mask Cool Hands-on
 - Afternoon
 - HVOF Overview
 - HVOF Systems
 - Q and A Session
- Day 5
 - Morning
 - HVOF Gun Re-build
 - Powder Hopper Re-build
 - Afternoon
 - HVOF Hands-on
 - Facility Problems
 - Wrap up session

