Helium Recovery System designed for Cold Spraying

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Industrial Materials Institute of the National Research Council (NRC-IMI), Canada

Sylvain Desaulniers, Eng, MBA - Day 1 workshop
PRESENTATION AGENDA

- About Polycontrols
- Benefits to use He on Coatings
  - Particles velocity
  - Microstructure
- HRS System description
- System evaluation
  - Performance
  - Efficiency
- Cost/benefits analysis
- Acknowledgements

*HRS : Helium recovery System*
ABOUT POLYCONTROLS ...

• Flow focused company

• The largest flow calibration laboratory in Canada.
  • Gasses, liquids
  • ISO/IEC 17025 certified
  • Main industry serviced: Aerospace, Fuel Cell

Flow lab - Primary standard  Flow lab – Liquids & Fuel shop  Flow lab – Gas lab
• Flow system – Manufacturer of systems for specialty gases.
  • Hydrogen, Oxygen, Corrosives, Acids & Super Acids
  • Main industry deserved: Automotive, Metallurgy, Research
BENEFITS TO USE HELIUM ON COATINGS

- Highest Particles Velocity

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**Sources:** NRC-CNRC, Using system Kinetiks 4000 (40 bar), Measured using DPV 2000
BENEFITS TO USE HELIUM ON COATINGS

- Microstructure: No porosity
- Inert gas: No risk of oxidation and/or nitridation

Cp Ti

$N_2$
MOC24
800 °C

Efficiency: 100%
Porosity: 2%

He
ASB VH70
350 °C

Efficiency: 100%
Porosity: 0%

Sources: NRC-CNRC, Substrate mild steel
HRS SYSTEM DESCRIPTION ...
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Spray room & He storage tanks

Helium High pressure booster

Filtration & gas separation unit
Recovery rate in steady state operation (at full capacity)

Global efficiency: Includes all losses from the HRS, dust collector, spray chambers, loading and unloading operation.

Steady state: All data excluding the initial start-up and stabilization phases.
Recovery rate while varying the gun demand

Global Efficiency = Recycled Helium / Helium to the gun
Energy consumption: 1/2Kw per normal cubic meter (nm3)
COST/BENEFITS ANALYSIS

- Considering that the Helium costs is 10 times more expensive than the N2 and the HRS efficiency is 90%: the cost of spraying using Helium is comparative to the cost of spraying using N2. However, capital investment needs to be assess on a case by case basis.

- Spraying using He enables coating with better properties (lower porosity).

- Spraying using He is less sensitive to charge effect (velocity is maintained with particle feed rate up to 3 time that of nitrogen)

- By using the proper nozzle materials, it would be possible to spray using Helium at higher temperatures reducing the flow rate

Sources: NRC-CNRC, Using system Kinetiks 4000 (40 bar), Measured using DPV 2000
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