



Helium Recovery System designed for Cold Spraying

2nd Canadian Cold Spray Conference (CCSC), June 2010

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

Sylvain Desaulniers, Eng, MBA - Day 1 workshop

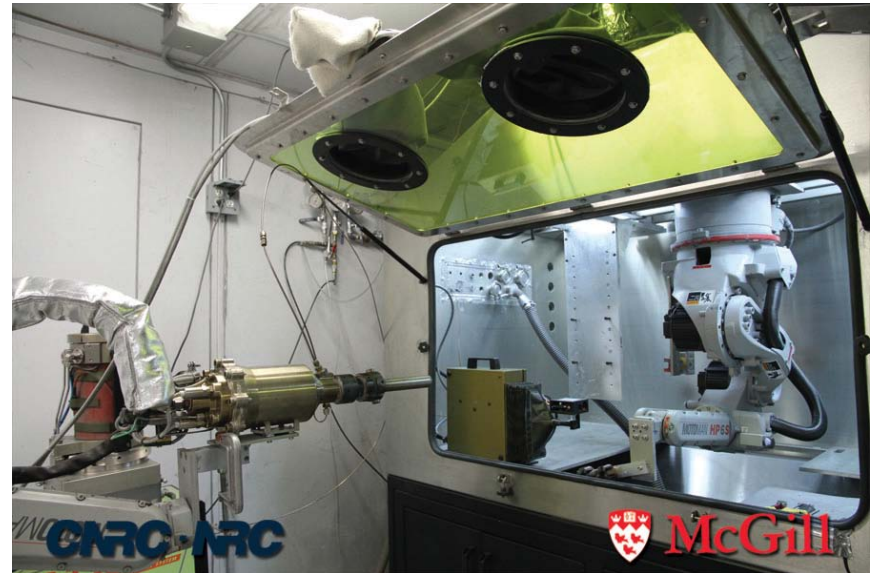


PRESENTATION AGENDA

- 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

POLYCONTROLS 





ABOUT POLYCONTROLS ...

- Flow focused company
- The largest flow calibration laboratory in Canada.
 - Gasses, liquids
 - ISO/IEC 17025 certified
 - Main industry serviced : **Aerospace, Fuel Cell**



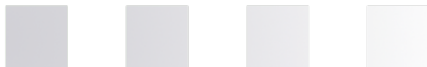
Flow lab - Primary standard



Flow lab – Liquids & Fuel shop



Flow lab – Gas lab





ABOUT POLYCONTROLS ...

- Flow system – Manufacturer of systems for specialty gases.
 - Hydrogen, Oxygen, Corrosives, Acids & Super Acids
 - Main industry deserved: **Automotive, Metallurgy, Reacherch**



CO2 & Cryogenic



3M – Specialty fluids



H2 / Argon

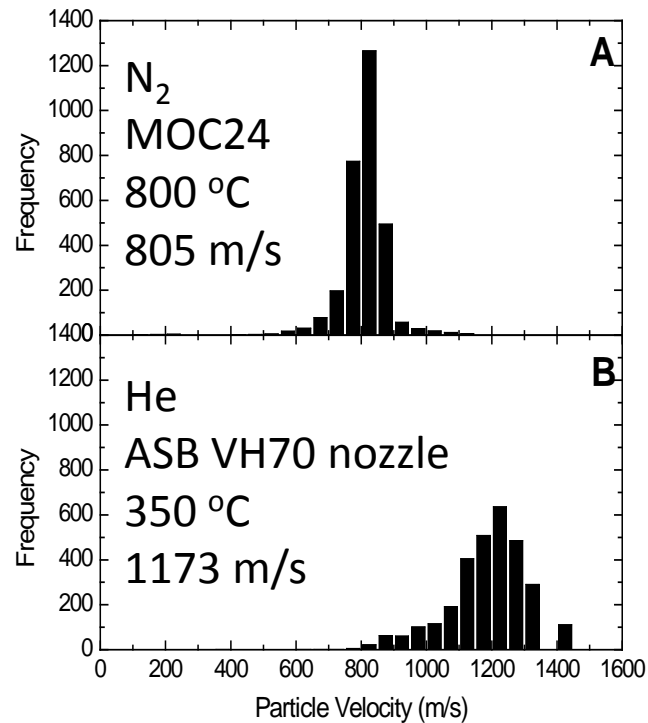




BENEFITS TO USE HELIUM ON COATINGS

- Highest Particules Velocity

Cp Ti plasma atomized (spherical)



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



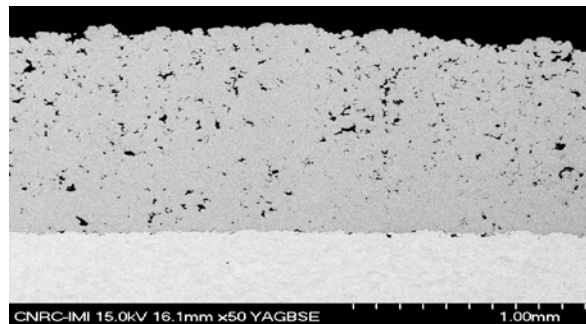


BENEFITS TO USE HELIUM ON COATINGS

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

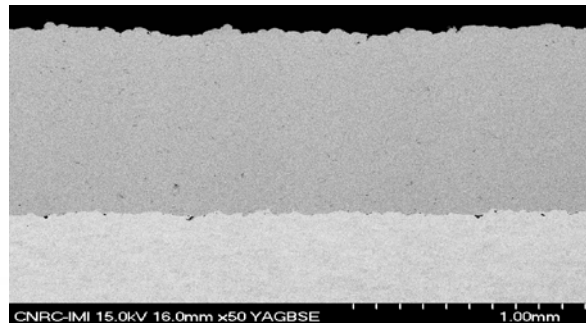
Cp Ti

N₂
MOC24
800 °C



Efficiency: 100%
Porosity: 2%

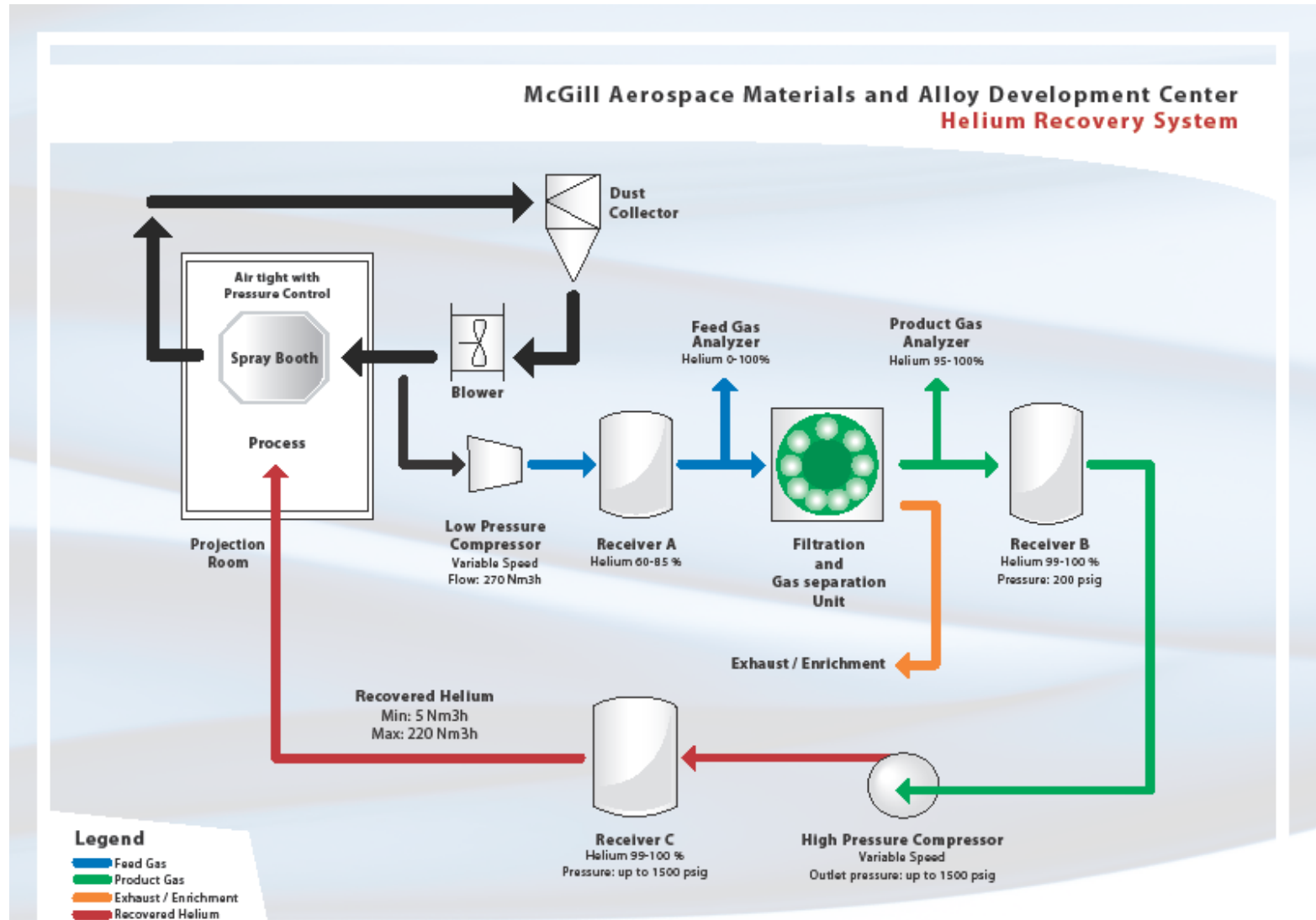
He
ASB VH70
350 °C



Efficiency: 100%
Porosity: 0%



HRS SYSTEM DESCRIPTION ...





HRS SYSTEM DESCRIPTION ...



Spray room & He storage tanks



Helium High pressure booster



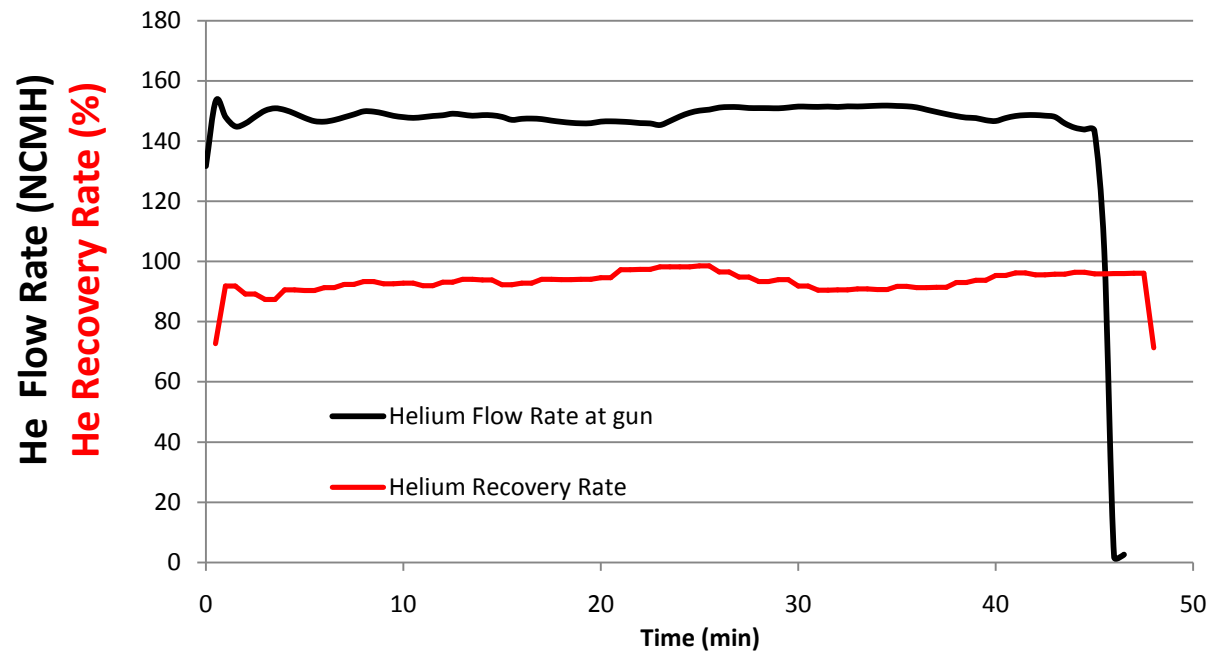
Filtration & gas separation unit





SYSTEM EVALUATION

Recovery rate in steady state operation (at full capacity)



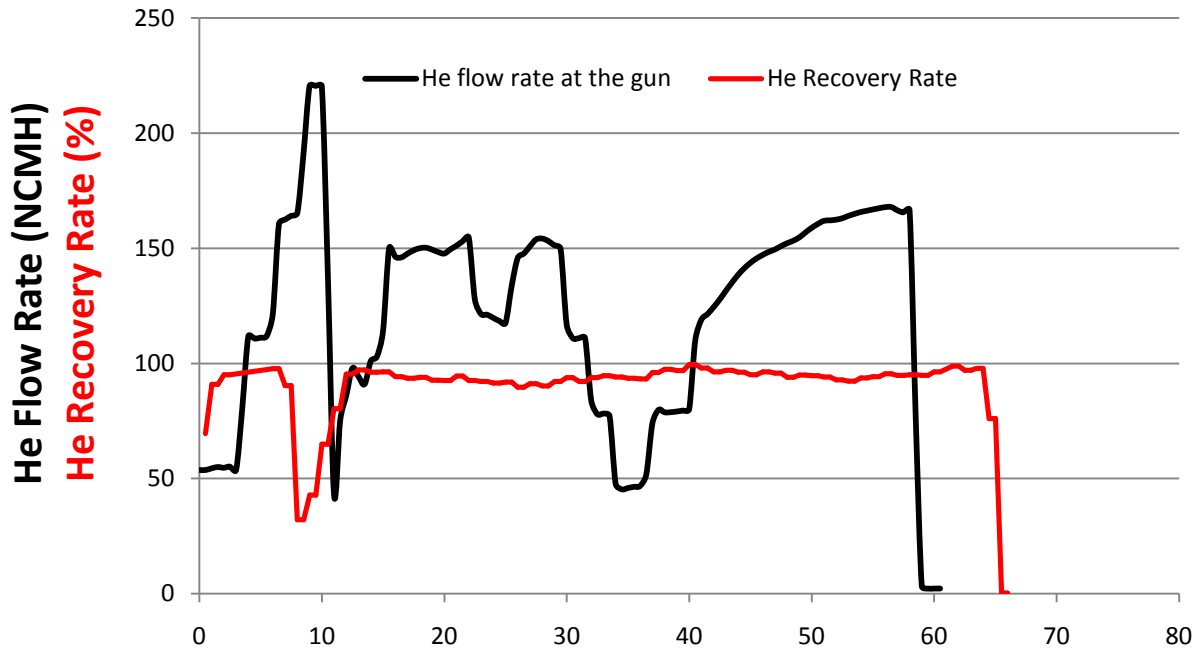
Efficiency:
Global 88%
HRS 95+%

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



Efficiency:
Global 88%
HRS 95+%

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 assessed 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 times that of nitrogen)
- By using the proper nozzle materials, it would be possible to spray using Helium at higher temperatures reducing the flow rate





ACKNOWLEDGMENTS

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- Technical and support staff from NRC/IMI and McGill University

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