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From scientific breakthrough to successful product development in thermal spray: from the lab to the industry
Poirier, Dominique

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Thermal Spray Open Mic Series: Monthly Virtual Event Geared toward Students and Emerging Professionals, 2021-11-17

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From scientific breakthrough to successful product development

Dr. Dominique Poirier
Research Officer
National Research Council of Canada, Boucherville

Below the tip of the iceberg...

Paper writing

Modelling

Conference talks

Literature review

Experimental work

Data analysis



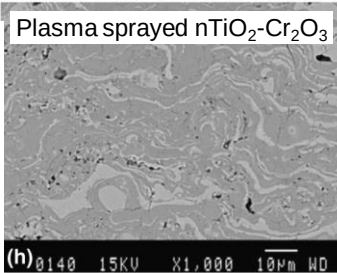
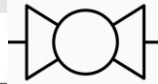
Three technical successes...

JTTEES 25:1068-1078
DOI: 10.1007/s11666-016-0405-9
1059-9630/16/00019-00 © ASM International

Nanostructured and Conventional Cr_2O_3 , TiO_2 , and $\text{TiO}_2\text{-Cr}_2\text{O}_3$ Thermal-Sprayed Coatings for Metal-Seated Ball Valve Applications in Hydrometallurgy

Luc Vernhes, Craig Bekins, Nicolas Lourdel, Dominique Poirier, Rogerio S. Lima, Duanjie Li, and Jolanta E. Klemberg-Sapieha

(Submitted August 11, 2015; in revised form March 12, 2016)



J Therm Spray Tech (2019) 28:291-304
<https://doi.org/10.1007/s11666-018-0805-0>

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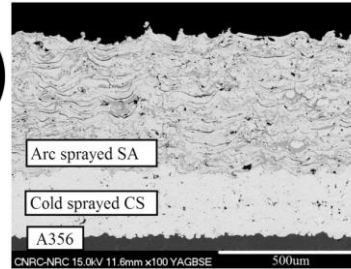
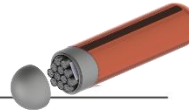


Performance Assessment of Protective Thermal Spray Coatings for Lightweight Al Brake Rotor Disks

Dominique Poirier¹ · Jean-Gabriel Legoux¹ · Eric Irissou¹ · Danick Gallant² · Jimmy Jiang³ · Tim Potter⁴ · James Boileau⁴

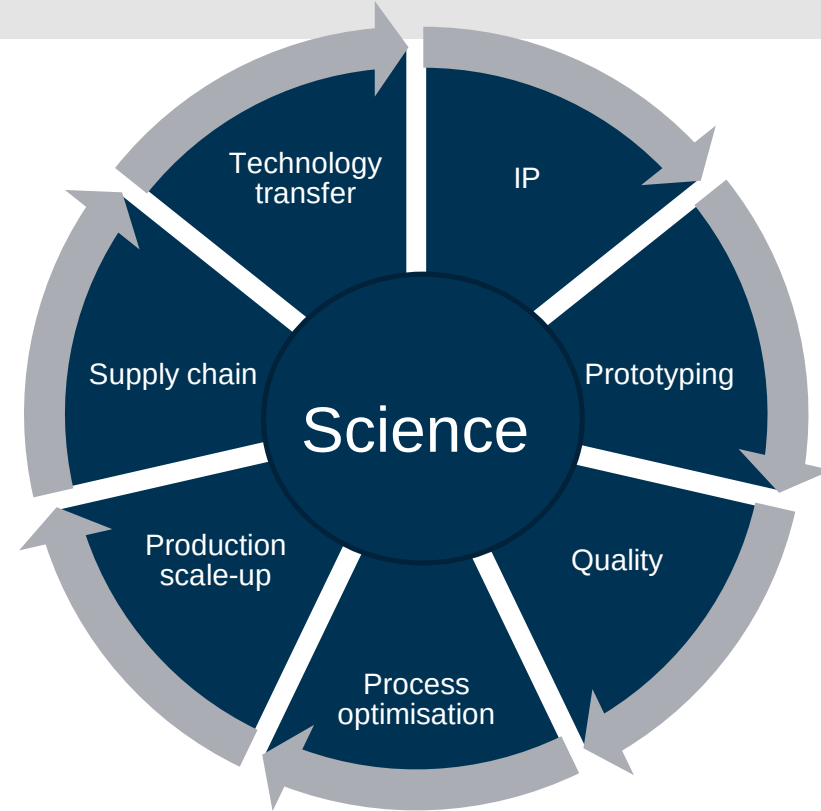
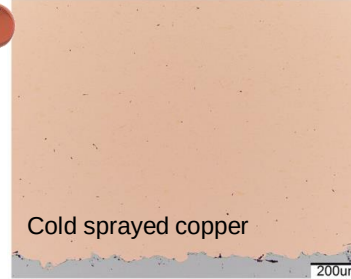
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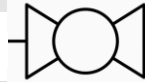
Powder Development and Qualification for High-Performance Cold Spray Copper Coatings on Steel Substrates

Dominique Poirier¹ · Jean-Gabriel Legoux¹ · Phuong Vo¹ · Bruno Blais¹ · Jason D. Gallonardo² · Peter G. Keech²



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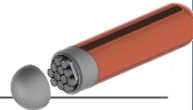


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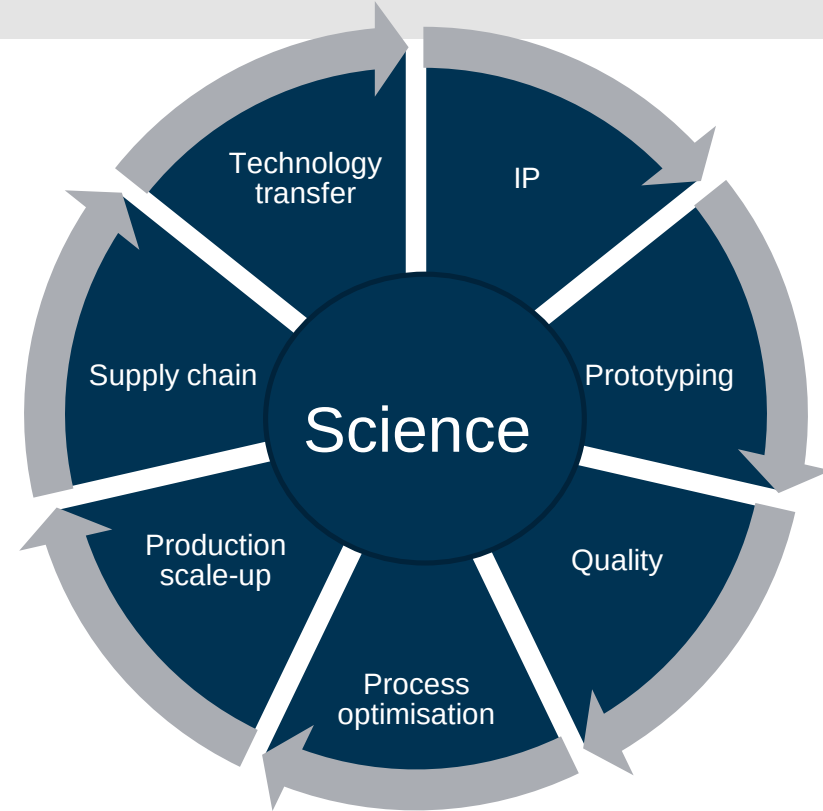
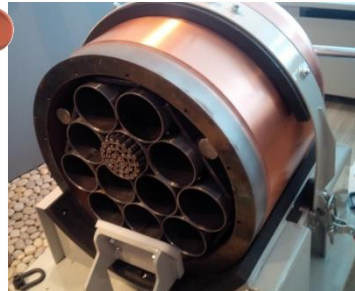
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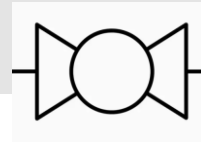


Intellectual property

« intangible creations of the human intellect”;
copyrights, patents, trade secrets...

Team work with IP professionals, such as a patent agent
or an IP lawyer:

- IP identification and filing
- Strategy development to protect and enforce IP
- Strategy development to maximize IP value



Mechanical part with a nanostructured $\text{tio}_2\text{-cr}_2\text{o}_3$ ceramic coating and method for depositing a nanostructured $\text{tio}_2\text{-cr}_2\text{o}_3$ ceramic coating on a substrate, CA2851939C

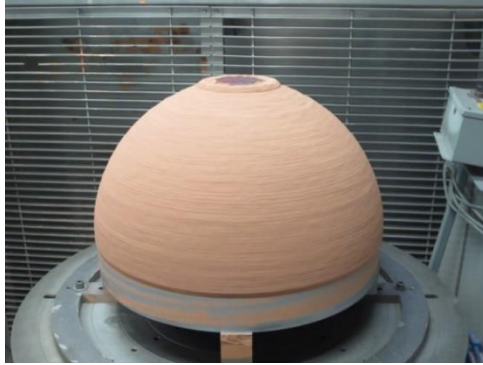


Bi-layer iron coating of lightweight metallic substrate, GB2541610B



Publications,
Technical reports

Prototyping



- Complex shapes
- Large parts
- Productivity

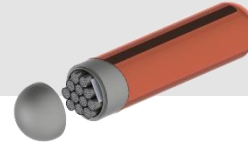
Quality

Activities and tasks needed to maintain a desired level of excellence



- **Definition of specifications and work instructions (including EH&S)**
 - Identification of key parameters.
 - Definition of parameter ranges of acceptability. *ISO 9001*
ISO 17025
- **Quality control**
 - What process parameters do we need to monitor and how do we do it?
 - Inspections / coating characterisation → *Technical standards (ASTM...)
- **Non conformances and root cause analysis (including EH&S)**

Process Optimisation



- Improving coating properties
- Minimizing costs / Maximizing throughput
 - Automation
 - Increase powder feedrate and process speed
 - Broaden specifications
 - Continuous identification of bottlenecks

Estimated time to add a 1 mm thick coating on a brake pad running surface of 1500 cm² (600g per side):



Cold Spray, 20g/min	60 min
Cold Spray, 100g/min	12 min
Arc spray, 300 g/min	4 min



Laser Cleaned Surface



Laser Assisted Adhesion Layer

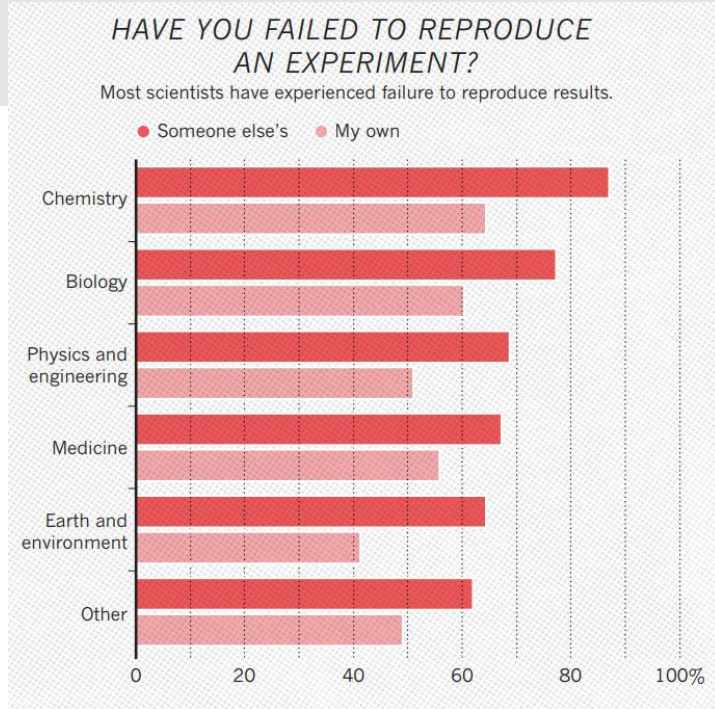
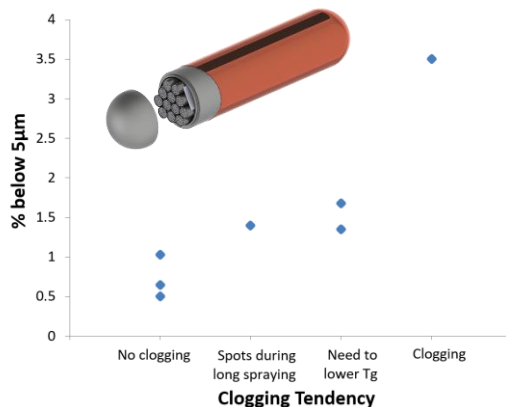


Final Coating

Production scale-up

Reproducibility and productivity are key

- Manufacturing traveler/Inspection and test plan
- Continuous improvement
- Refine process specs over time via feedback loops

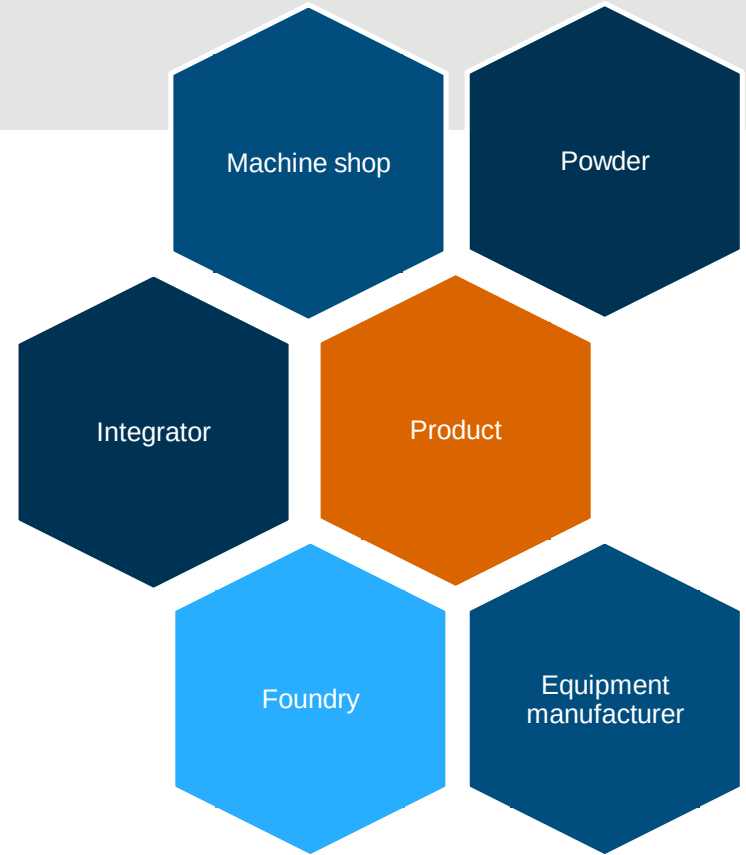


Baker M., Penny D., Is there a reproducibility crisis, Nature, vol 533(7604), may 2016, 452-454

Supply chain



- **Subcontract or produce in-house**
- **Incremental change easier than disruptive technology**
- **Some fields more difficult to enter than others...**



Technological Transfer

- Process adjustments
- Process qualification at the new facility
- Operational training – close relationships needed



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Process optimisation

IP

Prototyping

Technology transfer

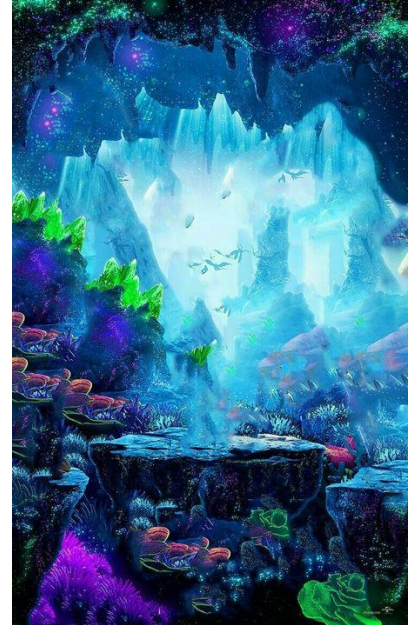
Supply chain

Quality

Production scale-up

...

there is a hidden world...



THANK YOU

Dominique Poirier • Research Officer • Dominique.Poirier@cnrc-nrc.gc.ca