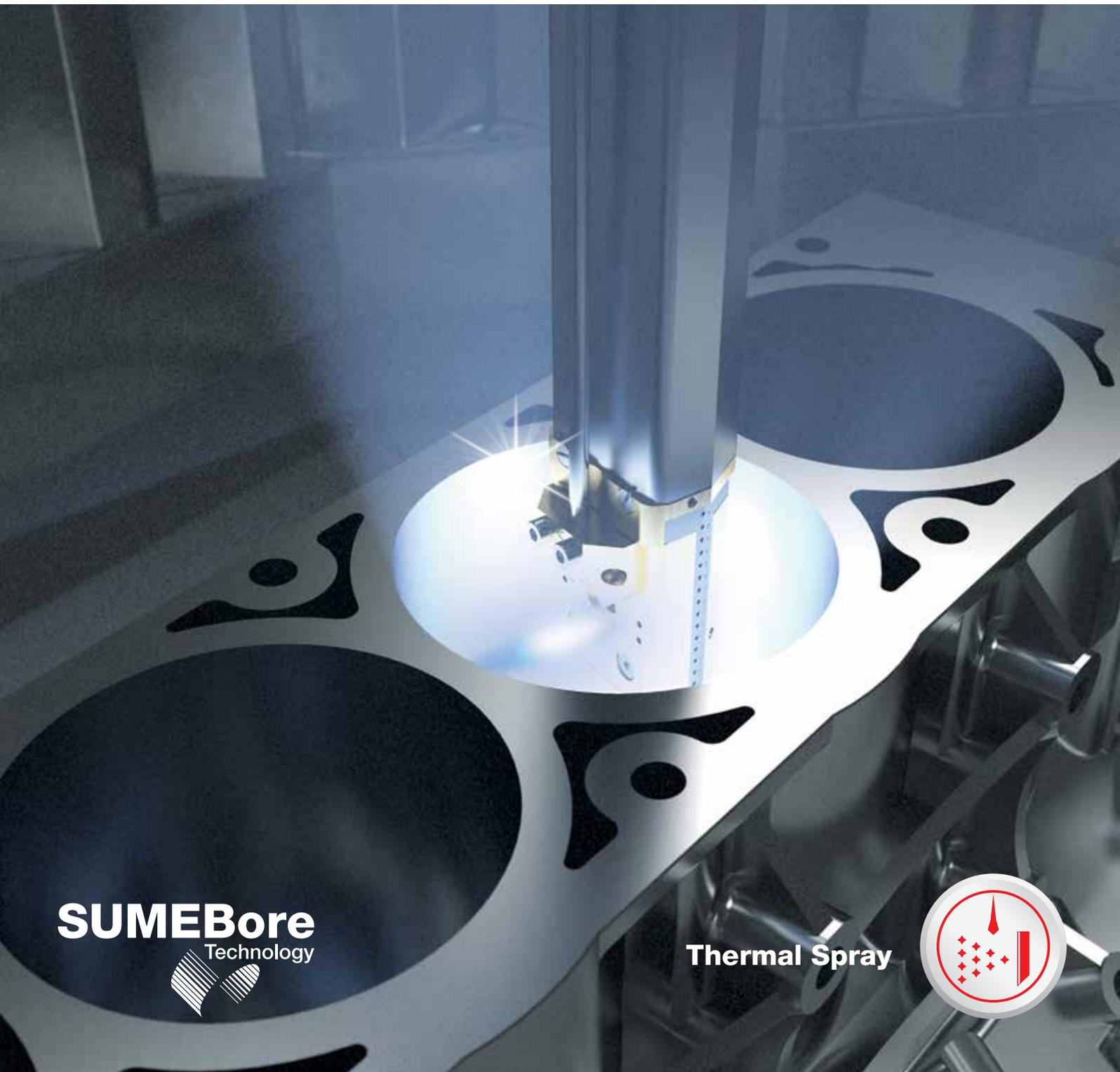


SUMEBore

High-Performance Cylinder Bore Coatings



Don't Compromise on Your Targets

Do you want to reduce friction, wear, corrosion, oil consumption, fuel consumption, emissions and weight while increasing engine performance?

Oerlikon Metco's SUMEBore™ is a powder-based thermal spray cylinder bore coating solution that meets key challenges of internal combustion engine manufacturers in automotive, marine, aero and power generation industries. SUMEBore can be tailored to meet the performance targets of your engine design.

- Improve fuel economy with low friction coatings and lighter, more compact engines
- Increase corrosion and wear resistance for consistent long-term performance
- Reduce oil consumption by up to 82%
- Meet specific coating requirements where other technologies fail

Take Your Coating Process to a New Level

Boost your productivity and benefit from improvements that significantly reduce the cost per bore with the RotaPlasma™ HS1 gun handling system.

- Increase the flexibility and performance of plasma sprayed coatings at a competitive cost per bore
- Achieve up to 4-times faster coating process speeds compared to the original RotaPlasma
- All but eliminate downtime from gun changeover and significantly reduce maintenance requirements



SUMEBore coating technology helps you achieve your emission reduction goals and meet strict regulations

- Improve fuel economy up to 4% with optimized coating solutions
- Eliminate the cast iron cylinder liner to reduce engine weight and fuel consumption, and improve heat transfer
- Reduce oil consumption up to 82% thanks to superior surface properties



Tailored SUMEBore coatings enable you to max out engine performance and ensure reliable operation

- Increase corrosion and wear resistance for peak performance throughout the entire vehicle lifetime
- Boost engine performance up to 4% with optimized cylinder liner and piston ring coatings
- Improve the cold start performance of hybrid engines



The SUMEBore coating solution is flexible and customizable, moving beyond the limitations of other coating technologies

- Easily coat complex geometrical components such as compact blocks and small cylinder diameters
- Rework used engine blocks to save costs and improve sustainability
- Utilize our know-how and experience that takes you from the development stage to mass production — wherever you are located

The SUMEBore Solution Package

Over the past 20 years, Oerlikon Metco has engaged extensively with leading OEMs and invested significant resources to develop functional coating solutions for combustion engine cylinders. The SUMEBore solution package, which can be tailored to different applications and customer requirements, includes:

- Development and prototyping capabilities
- The coating material (customized powder)
- The coating system
- The necessary know-how including the rights to use all relevant intellectual property to carry out the SUMEBore process

The Atmospheric Plasma Spray Coating Process



SUMEBore is a powder-based atmospheric plasma spray coating process for cylinder bore surfaces. The SUMEBore solution package can be easily integrated into your production setup from prototype to mass production.

Complete coating solution with SUMEBore

Together with key industry partners, Oerlikon Metco offers the industrialization of the entire coating process, from surface activation to the application of the plasma coating through the final machining.

Efficient production systems

A SUMEBore engineered system is customized to meet your requirements for part size, production quantities and variability.

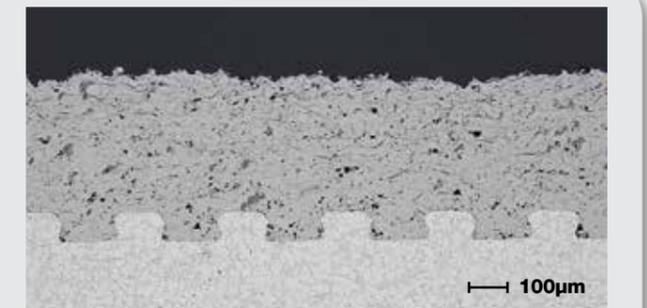
Tailor the Process to Your Requirements

The SUMEBore materials toolbox is based on modular powder chemistries that can address all issues that occur in a combustion engine cylinder such as friction, scuffing, corrosion and abrasive wear.

	Metals	Blends		Oxide Ceramics
Matrix Material	Low alloyed carbon steel	Low alloyed carbon steel	Chromium steel	TiO ₂ / Cr ₂ O ₃
Blended Material		+ Molybdenum	+ Oxide ceramics	
Friction Reduction	+	+ (+)	+ (+)	+++
Wear Resistance	+	+	++	++++
Corrosion Protection	+	+	++	++++
SUMEBore Powders	XPT 512	F4405	F2071	F6418

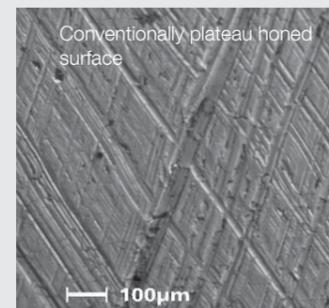
+ = basic, ++ = advanced, +++ = high, ++++ = very high

The powder-based nature of SUMEBore materials is significantly more flexible for customizable coatings. The range of materials extends from fully metallic (mainly iron-based) to metal matrix composites (MMC), and ultimately to pure ceramics.

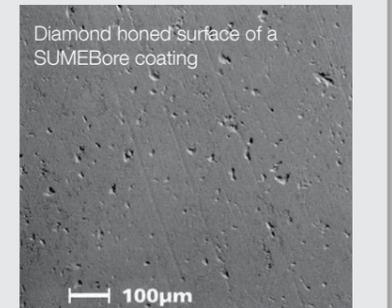


Metallographic section of XPT 512 — a low alloyed carbon steel on a mechanically activated bore surface (as-sprayed).

Enhanced Hydrodynamic Behavior



The plasma coatings are “mirror finished” by diamond honing. The oil is retained in the small, open pores on the surface which leads to enhanced hydrodynamic behavior and friction reduction potential. Although SUMEBore coatings are wear-resistant, the homogeneous distribution of these pores throughout the coating guarantees consistent performance throughout the life of the engine as new pores are exposed as the coating wears.



Atmospheric Plasma Spray vs. Wire Spray

Powder-based atmospheric plasma spray (APS) always had one key advantage over wire spray: the ability to choose from a broad range of materials and to combine several materials to impart multiple benefits on the substrate. These benefits include friction reduction, wear and corrosion resistance. Today, APS outperforms wire spray in the most relevant of process criteria at a comparable cost per bore.

Process Criteria	Atmospheric Plasma Spray	Wire Spray
Materials choice APS offers a broad selection of materials and allows for customizable coatings including metal powders, metal matrix composites and ceramics.	↑	↓
Thermal influence A high thermal influence can be detrimental to the substrate. Both technologies have a low thermal influence on the substrate.	↑	↑
Coating quality Thanks to the defined powder particle size, APS ensures reduced coating variability with better distribution of pores and oxides.	↑	→
Process reliability Both processes have demonstrated robust and reliable performance in the mass production of leading manufacturers.	↑	→
Coating roughness and thickness APS significantly reduces as-sprayed coating roughness and requires less coating to be applied resulting in reduced honing requirements.	↑	→
Process costs Increased efficiency of the APS process combined with reduced material production costs have resulted in a comparable cost per bore for both technologies.	→	→

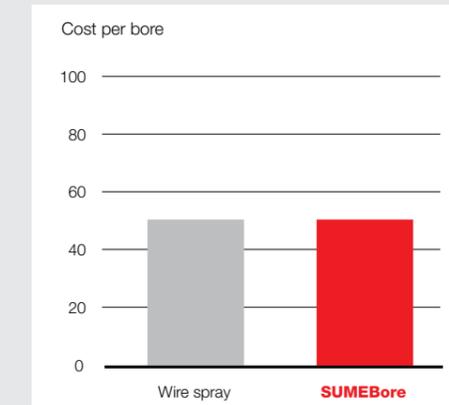
Significant Reduction in Process Costs

Oerlikon Metco is continuously working on improving the productivity of the SUMEBore solution package. Combining process efficiency improvements and material cost reductions have lowered the cost per cylinder bore by more than 50% compared to the baseline costs of 2014.

Cost per bore comparison 2014



Cost per bore comparison 2018



Basis for calculation:
 100,000 L4 blocks / year
 Ø = 74 mm (2.9 in)
 Depth = 130 mm (5.1 in)
 excluding honing costs

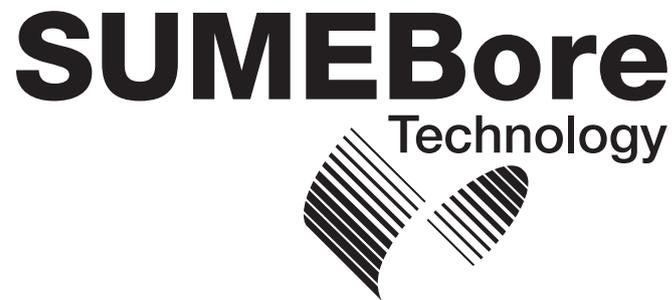


Now with a cost per bore comparable to wire spray technology, all the benefits of powder-based atmospheric plasma spray solutions are available at no extra cost.

- Benefit from a **mature and reliable process** that has been tested and implemented by numerous leading engine manufacturers including Volkswagen, BRP-Rotax, and Yamaha Motors.
- Use the benefits of metals and ceramics to **combine friction and wear reduction with corrosion resistance** in one coating.
- **Eliminate costly masking** thanks to new developments that minimize overspray and material residues.
- Realize additional cost savings thanks to significantly **reduced coating thickness** and thus reduced honing efforts.
- Save a costly, time-consuming step in the coating process because APS requires **no pre-heating** of the engine block.

SUMEBore Cylinder Bore Coatings

Advanced Technology Solutions and Services



Perfect solutions through optimum materials and innovative technologies

Oerlikon Metco is a global leader in surface engineering solutions and services offering:

- A broad range of thermal spray, laser cladding and other advanced surface technology equipment
- Integrated systems and materials
- Specialized coating and surface enhancement services
- Manufactured components for turbine, automotive and other industries
- Customer support services

Oerlikon Metco provides a comprehensive manufacturing, distribution and service network, catering to aviation, power generation, automotive and other strategic growth industries.

To take control of your surface engineering challenges, contact your Oerlikon Metco sales office, visit our web site at www.oerlikon.com/metco

or e-mail us at info.metco@oerlikon.com

About Oerlikon Metco

Oerlikon Metco enhances surfaces that bring benefits to customers through a uniquely broad range of surface technologies, equipment, materials, services, specialized machining services and components. The surface technologies such as Thermal Spray and Laser Cladding improve the performance and increase efficiency and reliability. Oerlikon Metco serves industries such as aviation, power generation, automotive, oil & gas, industrial and other specialized markets and operates a dynamically growing network of more than 50 sites in EMEA, Americas and Asia Pacific. Oerlikon Metco, together with Oerlikon Balzers, belongs to the Surface Solutions Segment of the Switzerland-based Oerlikon Group.

Information is subject to change without prior notice.