SPRAYWERX TECHNOLOGIES

SELECTION GUIDE

THE POWDER SELECTION MATRIX

Which thermal spray chemistry your part actually needs in 2026 — matched to wear mode, not habit. Including where the answer is still tungsten, and where it isn’t thermal spray at all.

SPRAYWERX TECHNOLOGIES INC.

North Vancouver, BC, Canada · spraywerx.com

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HOW TO READ THIS

Sixty seconds before you start

01 Chemistry follows wear mode. Price never changes the physics — but at 2026 powder prices — Western WC roughly 3–4× the 2024 era (~$80–110/kg) — approximate, dated August 2026, on APT feedstock up ~6× year over year — specifying by habit instead of wear mode is the most expensive default in your coating budget.

02 Start with the three questions below. They route ~90% of parts. The matrix on the following pages covers the rest, including the rows where we'll tell you to stay on tungsten.

03 Families first, products second. The engineering answer is the chemistry family; Spraywerx products are listed as reference implementations, and equivalents exist.

SECTION 01

Three questions that route most parts

QUESTION 1

Does the part run hot? Above roughly 450–500°C, WC-based coatings lose wear performance as the carbide phase oxidizes and decarburizes. If sustained service temperature is above that band, tungsten is the wrong answer regardless of price: chromium carbide (Cr3C2-NiCr) is the engineering choice, serviceable to ~870°C.

QUESTION 2

Is the dominant damage mechanism cavitation or corrosion, on a non-fatigue-critical part? Dense iron-based carboboride and amorphous chemistries resist cavitation and corrosive attack at a fraction of carbide's feedstock cost.

QUESTION 3

Is this build-up, dimensional restoration, or moderate wear? Nickel self-fluxing alloys were designed for exactly this. Parts in this class specified in WC-CoCr never needed carbide.

> Everything else — severe ambient abrasion, erosion, and qualified aerospace or chrome-replacement duty — lands in the matrix below, where WC-CoCr holds several rows on merit.

The matrix

SERVICE CONDITION	CHEMISTRY FAMILY	TYPICAL PROPERTIES (PUBLISHED RANGES)	SPRAYWERX REFERENCE	WATCH-OUTS
BASELINE — the coating you're leaving: hard chrome (EHC)	Electrolytic hard chrome	~800–1,000 HV; microcracked as deposited (connected crack network = corrosion path); hydrogen-embrittlement relief bake required on high-strength steel; REACH/CARB sunset clocks running	n/a — baseline	Every row below is measured against this. Chrome's real 2026 problem isn't performance — it's regulatory life expectancy
Severe abrasion / erosion at ambient temperature	WC-CoCr (86-10-4) — **stay on tungsten**	Typ. ~1,000–1,250 HV; porosity <1%; bond strength typically exceeds the ASTM C633 epoxy limit (>69 MPa); TWI: 4–5x the abrasion resistance of hard chrome; service to ~450–500°C	**WC104-FN**	Feedstock exposure HIGH in 2026 — attack cost through deposition efficiency and powder origin, not substitution
Qualified aerospace / flight-critical chrome replacement	WC-CoCr — **stay on tungsten**	DoD/HCAT-validated chrome replacement, rated equal or superior — including fatigue on high-strength steel; no hydrogen-embrittlement bake (no electrolytic hydrogen source)	**WC104-FN**	Do not substitute. Harvest DE and powder origin (DFARS clock, Jan 1, 2027) instead
Sustained service above ~450–500°C	Chromium carbide (Cr3C2-NiCr)	Typ. ~750–950 HV; retains wear performance to ~870°C where WC decarburizes; input costs calm (chromium +10–13% this cycle)	**CrC-7525**	At ambient temperature CrC gives up erosion performance vs WC-Co (~1.5x the erosion loss) — a high-temperature answer, not a cheap-tungsten answer

The matrix continues overleaf — including the rows where the honest answer isn't thermal spray at all.

SERVICE CONDITION	CHEMISTRY FAMILY	TYPICAL PROPERTIES (PUBLISHED RANGES)	SPRAYWERX REFERENCE	WATCH-OUTS
Cavitation and corrosion duty, non-fatigue parts	Iron-based carboboride / amorphous	Published family range ~700–1,100 HV; dense amorphous/fine-crystalline matrix resists cavitation and corrosive media at a fraction of carbide feedstock cost	**SPAC series**	Confirm fatigue-sensitivity limits for the application before specifying
Extreme sliding abrasion, cost-driven industrial duty	Iron-based carboboride	Hardness at the top of the Fe-based family range; inputs sit entirely outside the tungsten/cobalt squeeze	**SPAC 100 / SPAC 150**	Verify against your abrasive: hard-particle (mineral/glass) duty is the sweet spot
Build-up, dimensional restoration, moderate wear	Nickel self-fluxing alloy (NiCrBSi class)	Typ. ~350–700 HV grade-dependent; fused coatings approach full density; machinable; engineered for restoration duty	**NiWear88**	Carbide was never required here — this is the most common over-specification we see
Thin dense chrome-like duty on complex geometry	— evaluate beyond thermal spray	Some duties are better served by nitriding, laser cladding, or PTA overlay — an honest matrix says so	**n/a — ask us**	If a supplier never says “not thermal spray,” they’re selling powder, not engineering

On the numbers: property values are typical published ranges for properly applied HVOF coatings (ASM thermal spray references; HCAT program reports; TWI comparative testing); actual values depend on process parameters, powder cut, and geometry — which is why we publish measured data on your part, not brochure numbers. Chemistry families are the engineering answer; product names are Spraywerx reference implementations. Market figures trace to the Claims Register (tungsten ~6x y/y export benchmark; cobalt ~3x; chromium +10–13%; nickel modestly up).

SECTION 03

What you gain leaving chrome — beyond compliance

NO HYDROGEN EMBRITTLEMENT

HVOF deposits no electrolytic hydrogen — there is no relief-bake step, and no bake-window risk on high-strength steel (chrome requires embrittlement relief per ASTM B850).

FATIGUE PARITY OR BETTER

The HCAT program qualified HVOF WC-CoCr as equal or superior to EHC including fatigue behavior on high-strength steels — the historical objection to sprayed coatings on flight-critical parts.

POROSITY THAT DOESN'T CONNECT

Chrome's as-deposited microcrack network is a continuous corrosion path to the substrate; dense HVOF coatings carry <1% typically unconnected porosity.

THICKNESS FREEDOM

Heavy rebuilds in one operation instead of chrome's slow plate-up — relevant for restoration duty.

SECTION 04

Where the answer is still tungsten — make it cheaper without changing chemistry

Two of the seven rows above stay on WC-CoCr on merit. There the 2026 lever is not substitution, it's waste: at 45% deposition efficiency — the published HVOF norm is 45–55% — you buy 2.2 kg of powder per deposited kilogram; at 70% you buy 1.4 kg. On 2026 Western carbide prices that difference is $200+ per deposited kilogram before labor and gas. Demand measured DE data from any coating supplier, ours included.

For defense work, add the passport question: DFARS 252.225-7052 tungsten sourcing restrictions expand to mining and refining stages for China/Russia-origin material on January 1, 2027. Origin is now a compliance property of the coating, not a procurement detail.

Using this matrix

Pull your five highest powder-spend part numbers. For each, answer the three questions in Section 1 and find its row. If any part sits in a substitution row while specified in WC-CoCr, that is qualification-trial money — cycles run 12–24 months, and coupon-level data can start in days.

THE FASTEST VERSION OF THIS EXERCISE

A free 15-minute scoping call — we run your actual part geometry against the matrix and, where it's warranted, quote a prototype day ($5,000) at our North Vancouver facility on your part, not a test coupon. When the data says stay on WC-CoCr, we'll say that too.

Mini-Nova HVOF over a cylinder bore. Photo: National Research Council Canada.

~90%	2 of 7	12–24
of parts routed by the three questions in Section 1	matrix rows stay on WC-CoCr on merit	months per qualification cycle — coupon data can start in days

Where Spraywerx fits

Spraywerx builds internal-diameter HVOF systems (ID-Nova, Mini-Nova) and supplies the chemistry ladder this matrix describes — tungsten carbide where it earns its keep, chromium carbide, iron-based carboborides, and nickel alloys where they win. Companion briefs: “The Double Squeeze” (the regulatory and supply timeline) and “The 2026 Powder Economics Briefing” (the benchmark numbers behind the market figures cited here).

SOURCES

1. TWI comparative wear testing
2. DoD/HCAT hard-chrome-alternative validation program
3. Fastmarkets and CTIA tungsten benchmarks (Jun–Jul 2026)
4. CME/Benchmark cobalt reporting
5. Published HVOF deposition-efficiency norms
6. DFARS 252.225-7052 (FY2024 NDAA implementation)

Full citation list in the campaign Reference Index. Coating-property ranges are typical published values (ASM thermal spray references, HCAT program reports, TWI) for properly applied HVOF coatings.

SPRAYWERX TECHNOLOGIES

Patent-pending ID-HVOF technology for internal diameters down to 2.5" (63.5 mm). Thermal spray and laser cladding systems, powders, and coating development.

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