

2025

Composite Coating Machine of HUASHENG HD Series

- To be the top surface solution supplier in the world.
- Make every effort to minimize industrial energy consumption.



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01

INTRODUCTION

HD Series Introduction

- The HD series are built upon Huasheng's brand-new composite coating technology platform, enabling a composite process framework integrating **high-ionization sputtering and arc processes**. The films fabricated through this technology exhibit broader versatility. Notably, they demonstrate distinct advantages when dealing with **hard-to-machine materials**, including stainless steel and titanium alloys. This results in a substantial increase in service life.

- Moreover, this technology offers more potential for future process advancements. Simultaneously, it features excellent flexibility, making it capable of meeting the requirements of small-scale coating production as well as process research and development.



◆ **Brand-new Composite Ion Coating Equipment of HD Series**

HD Series Introduction

Technical Characteristics

Arc

- ✓ Optimize plasma anode to enhance film performance
- ✓ Plasma-assisted power supply, high target material utilization rate, lower cost
- ✓ Quick-change cathode magnetic field, compatible with different coating materials
- ✓ Hidden arc-starting structure, replaceable and easy to maintain

HiPIMS&DCMS

- ✓ Multiple sputtering modes meet the demands of more materials
- ✓ High ionization rate and high deposition rate simultaneously
- ✓ Fewer droplets, smoother surface
- ✓ Low interior stress and better adhesion
- ✓ Easier to reconcile the contradiction between film hardness and stress adjustment



◆ **Brand-new Composite Ion Coating Equipment of HD Series**

02

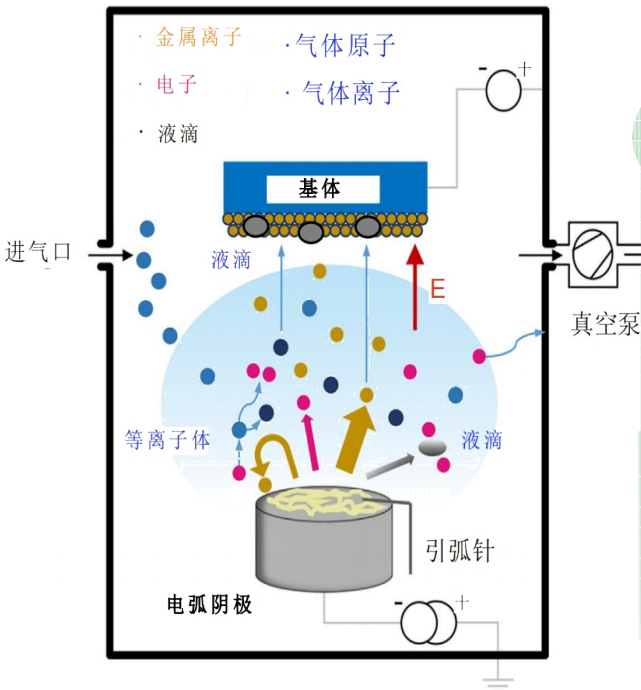
CHARACTERISTICS

HD500 Technical Characteristics



Huasheng HD500 Composite Machine
Combining the advantages of arc and magnetron control

Arc evaporation



Arc evaporation characteristics

High deposition rate
High ionization rate

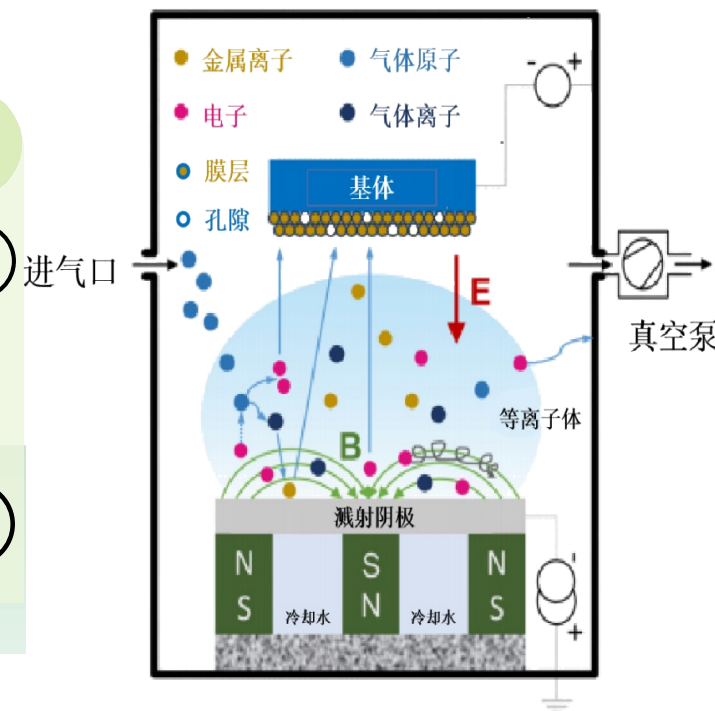
Many large droplets
Rough surface

Magnetron sputtering characteristics

Smooth surface
No large droplets

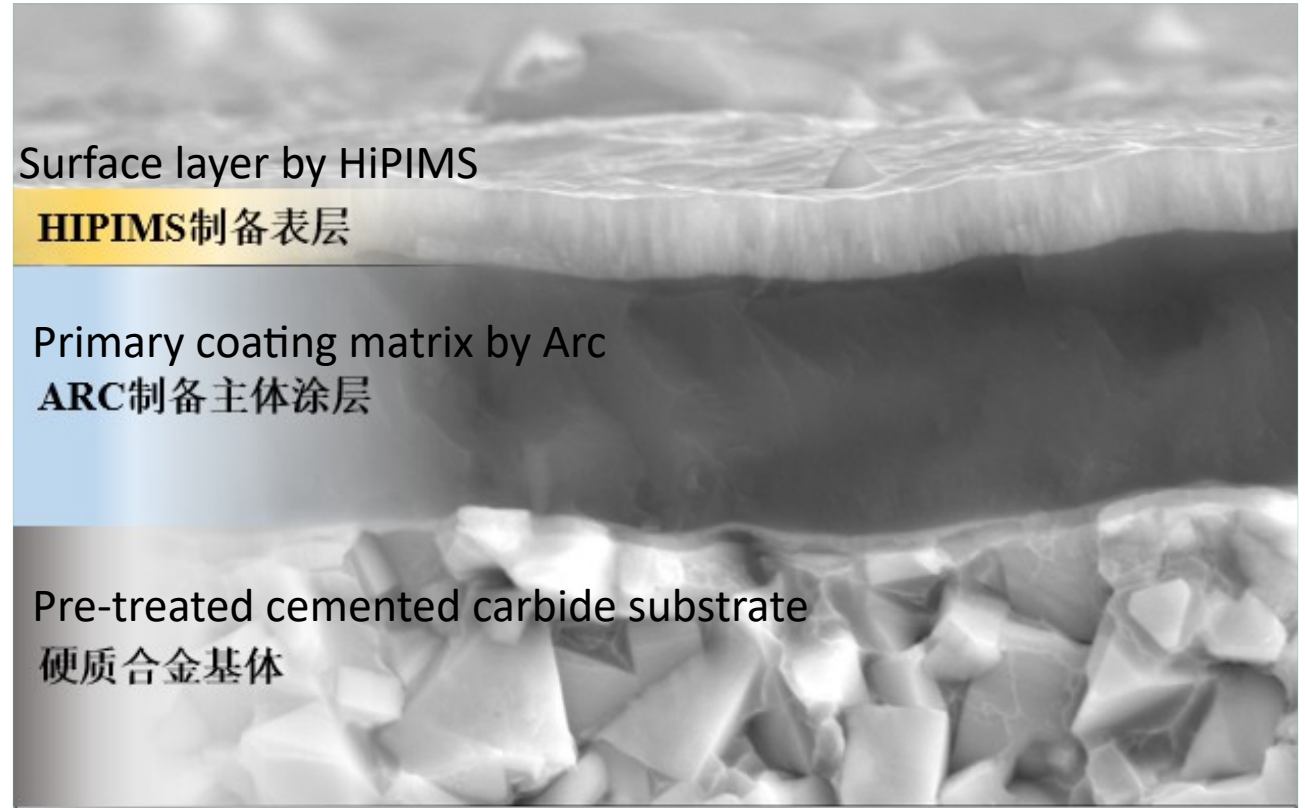
Low deposition rate
Low ionization rate

MS

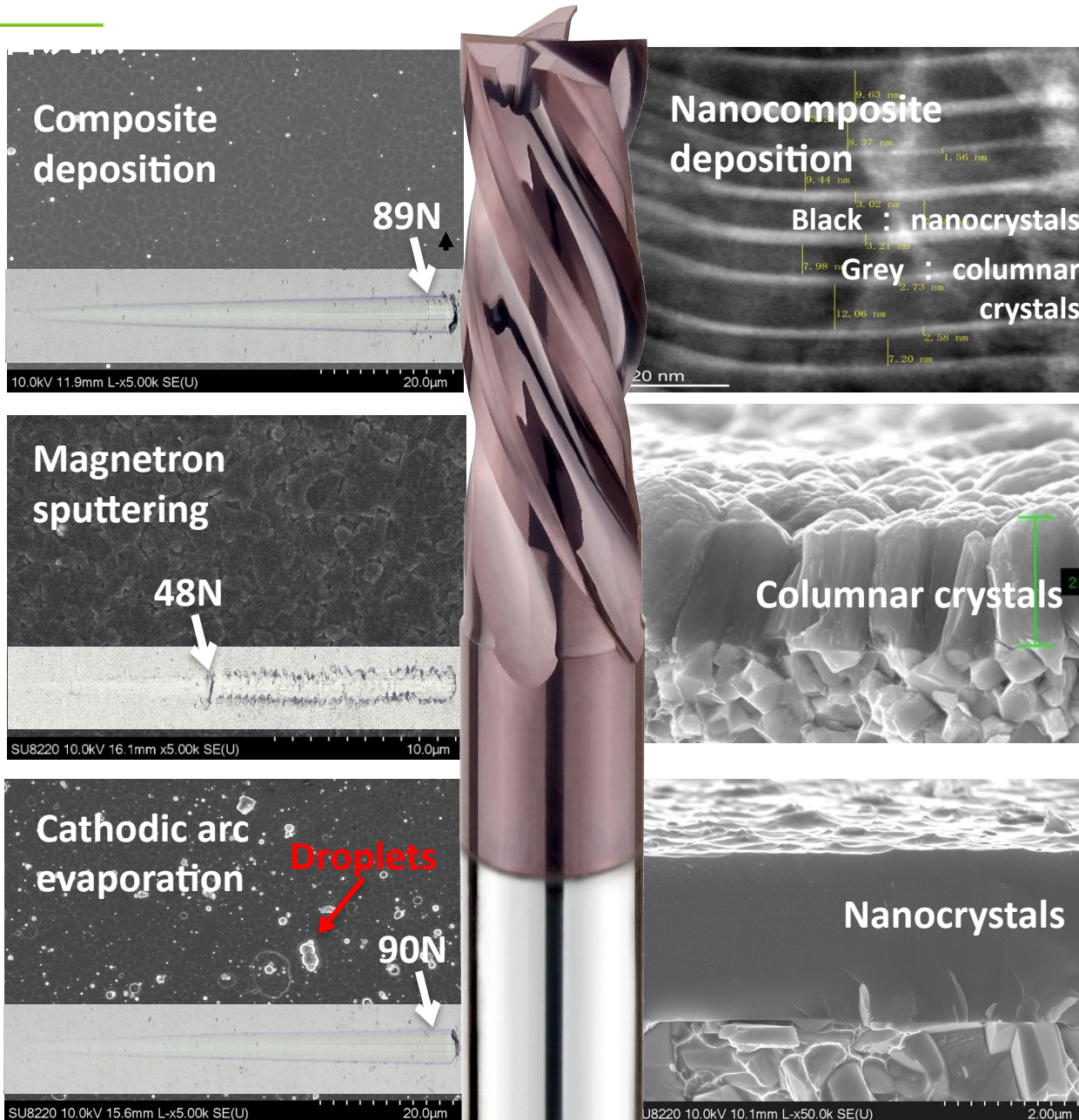


Arc Technology with HiPIMS Surface

The integrated cathode coating system achieves droplet-free deposition through optimized surface treatment. By utilizing ceramic targets with HiPIMS to deposit borides and carbides, the coating's friction coefficients can further decrease to meet the requirements for specialized working environments.



Composite Deposition Technical Characteristics



Characteristics of composite deposition technology:

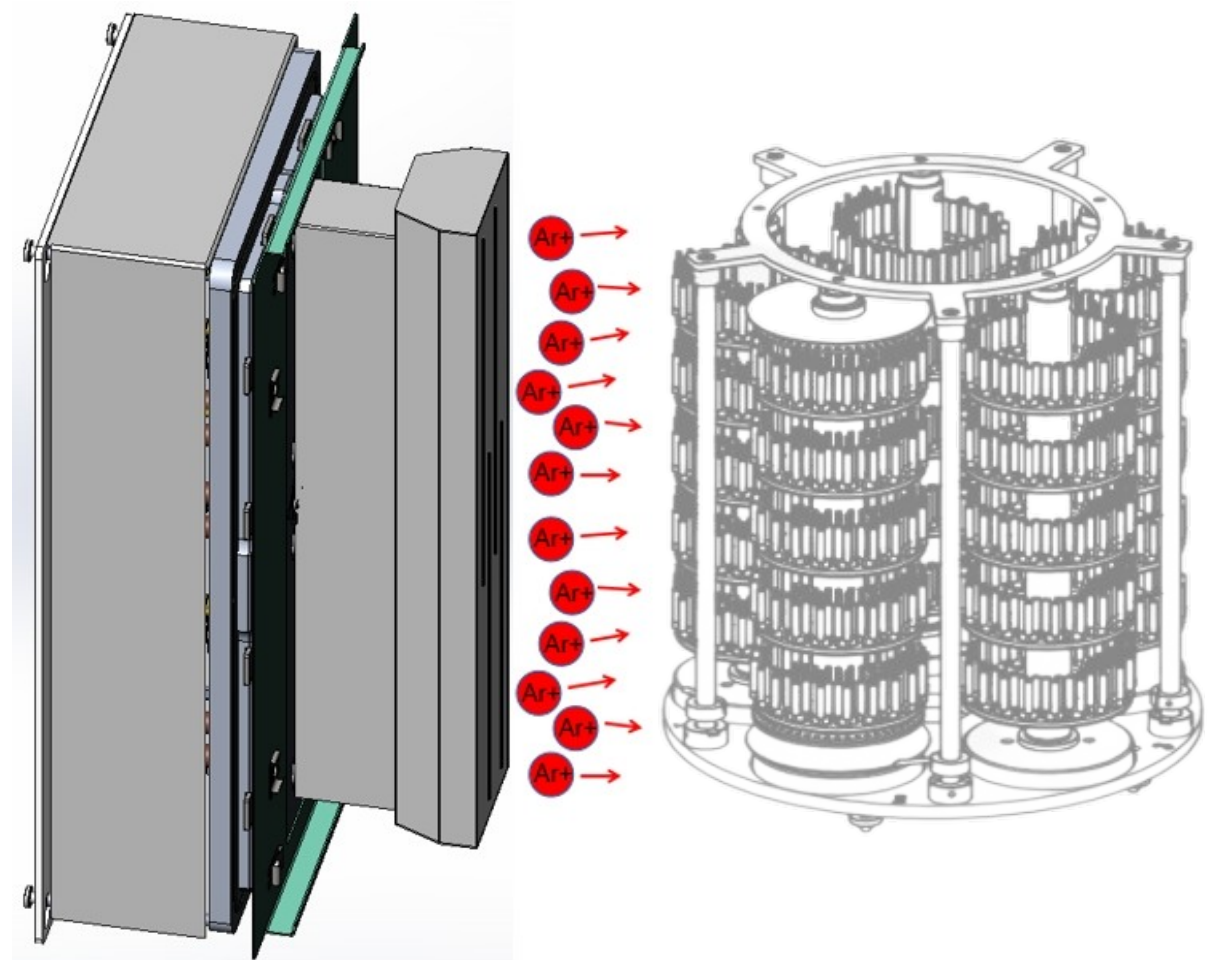
- Combining the feature of strong film-substrate **adhesion** of arc technology
- Combining the feature of **dense** coating of arc technology
- Combining the magnetron sputtering technology feature of **no droplets** on the coating surface and **low stress**
- Combining the feature of being able to deposit refractory metals of magnetron sputtering technology
- It **can control** the columnar crystal and nanocrystal of the coating and form nanolayer coherent growth.

HS Lateral Etching

Equipment Characteristics

- **Uniformity**
- **Excellent Etching Conformality**
- **Adjustable etching strength**
- **Maintenance-free**

WET



HD500 Technical Characteristics

● Unique Lateral Etching

- ✓ Outstanding uniformity in lateral etching
- ✓ Excellent etching overhang property and convenient maintenance

● Plasma-optimized Multi-arc Source

- ✓ Equipped with 3 groups of 6 circular multi-arc target sources, the concealed arc initiation mechanism is reliable and easy to maintain.
- ✓ It can easily achieve multi-element and multi-layer thin film deposition.
- ✓ The optimized plasma multi-arc source ensures a smoother thin film surface.
- ✓ The target material utilization rate is extremely high.

● Composite HiPIMS Magnetron Sputtering

- ✓ Equipped with DC + HiPIMS MS sources, it ensures high deposition rates while meeting the energy requirements for depositing refractory metals such as Nb, BC, W, V, etc., and is capable of depositing almost all materials.

● Multiple Deposition Technology Platforms

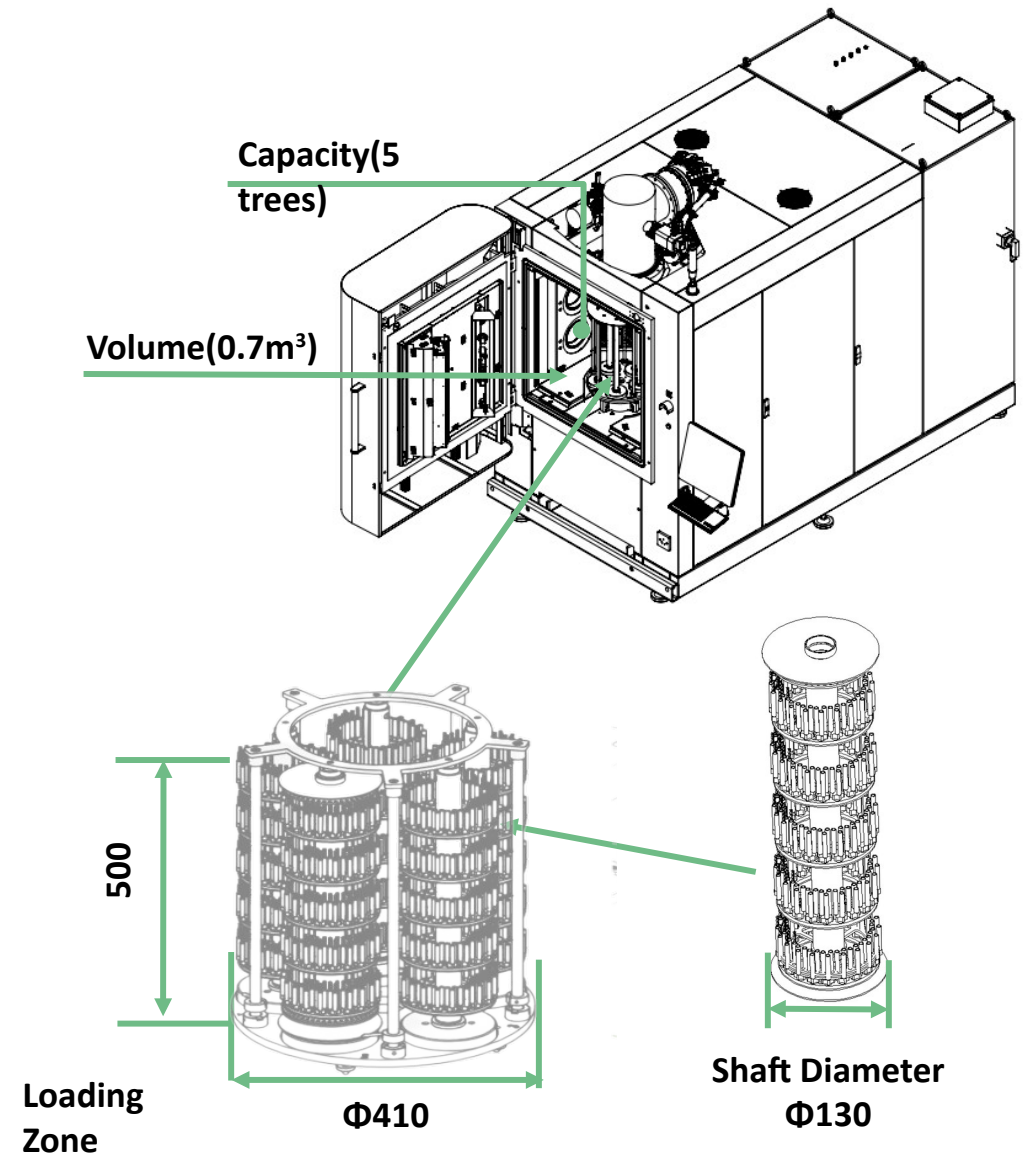
- ✓ Realize multiple thin film deposition technologies on the same platform, including DC MS + HiPIMS MS + multi-arc ion plating, and can implement single, composite, and mixed coating methods in the same batch.

03

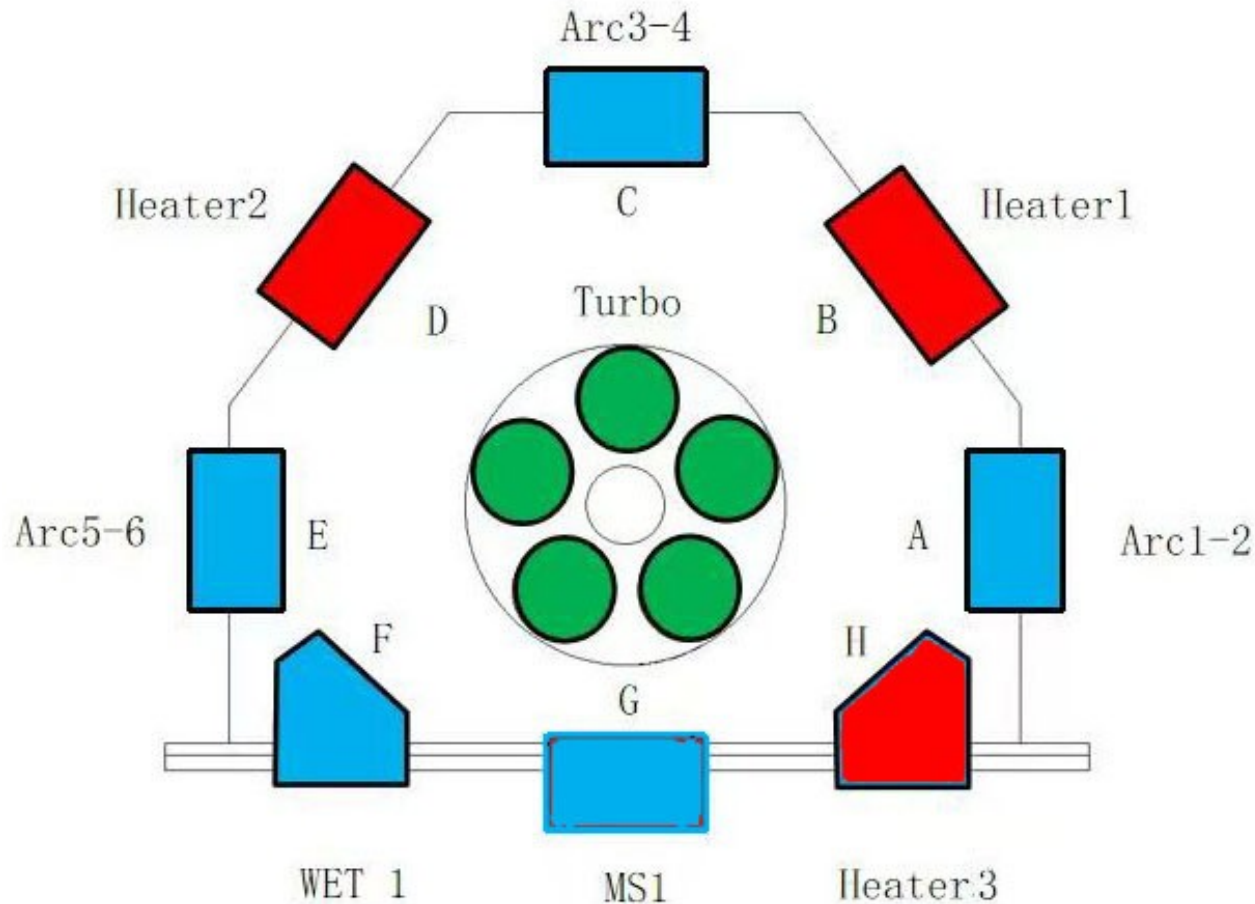
PARAMETERS

HD500 Parameters

Name	Parameter
Coating technology	Brand-new composite coating technology
Etching	Lateral ion source (hot filament)
Multi-arc sources (number)	6
Magnetron cathodes (number)	1
Equipment size (mm)	length3400*width1600 *height2600
Chamber volume (m ³)	0.7
Effective coating area (mm)	Φ410*400
Maximum working temperature (°C)	700
Loading capacity (number of trees)	5
Loading capacity of inserts (APMT1135)	6000pcs
Loading capacity of drills (D4*50L)	1800pcs
Maximum loading weight (KG)	300
Shaft diameter	Φ130
Process time	AlTiN : 6~8h



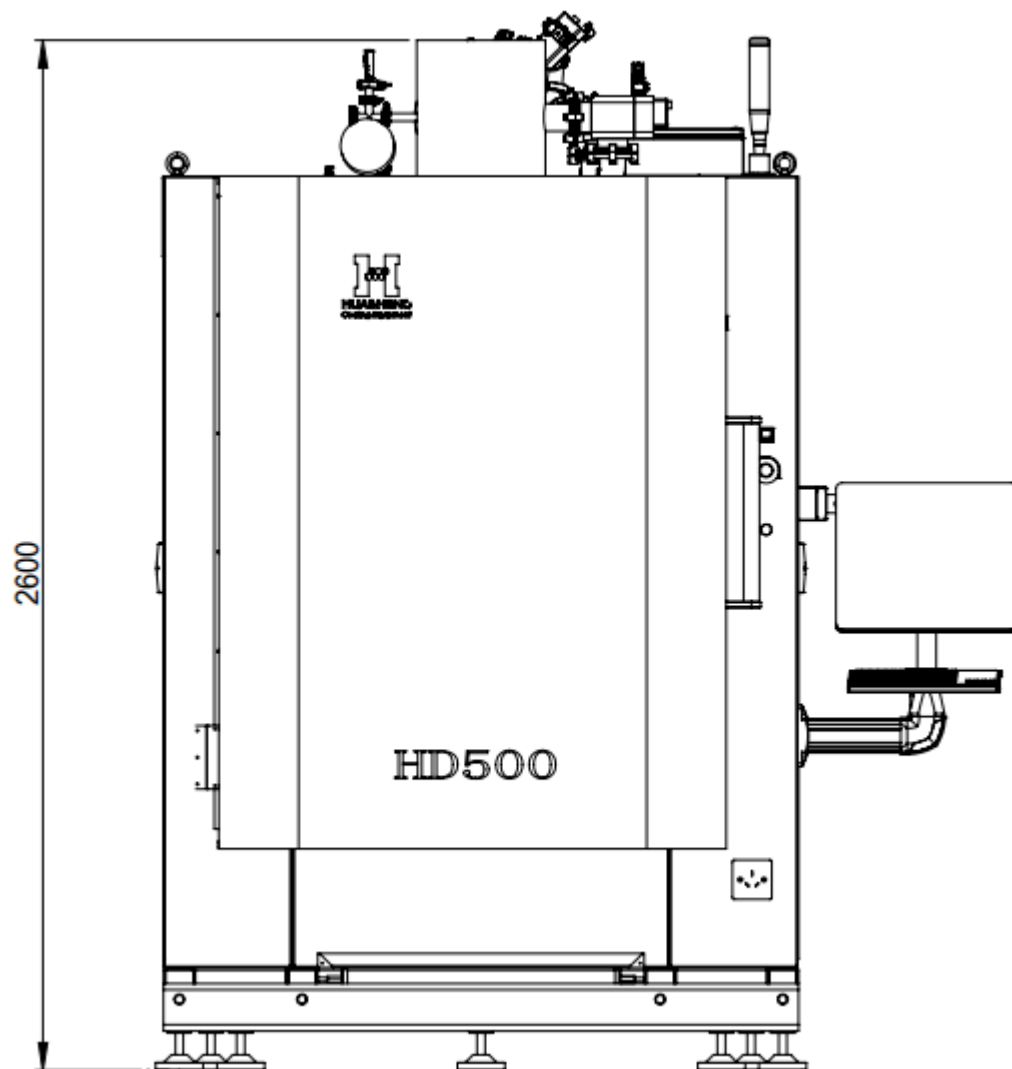
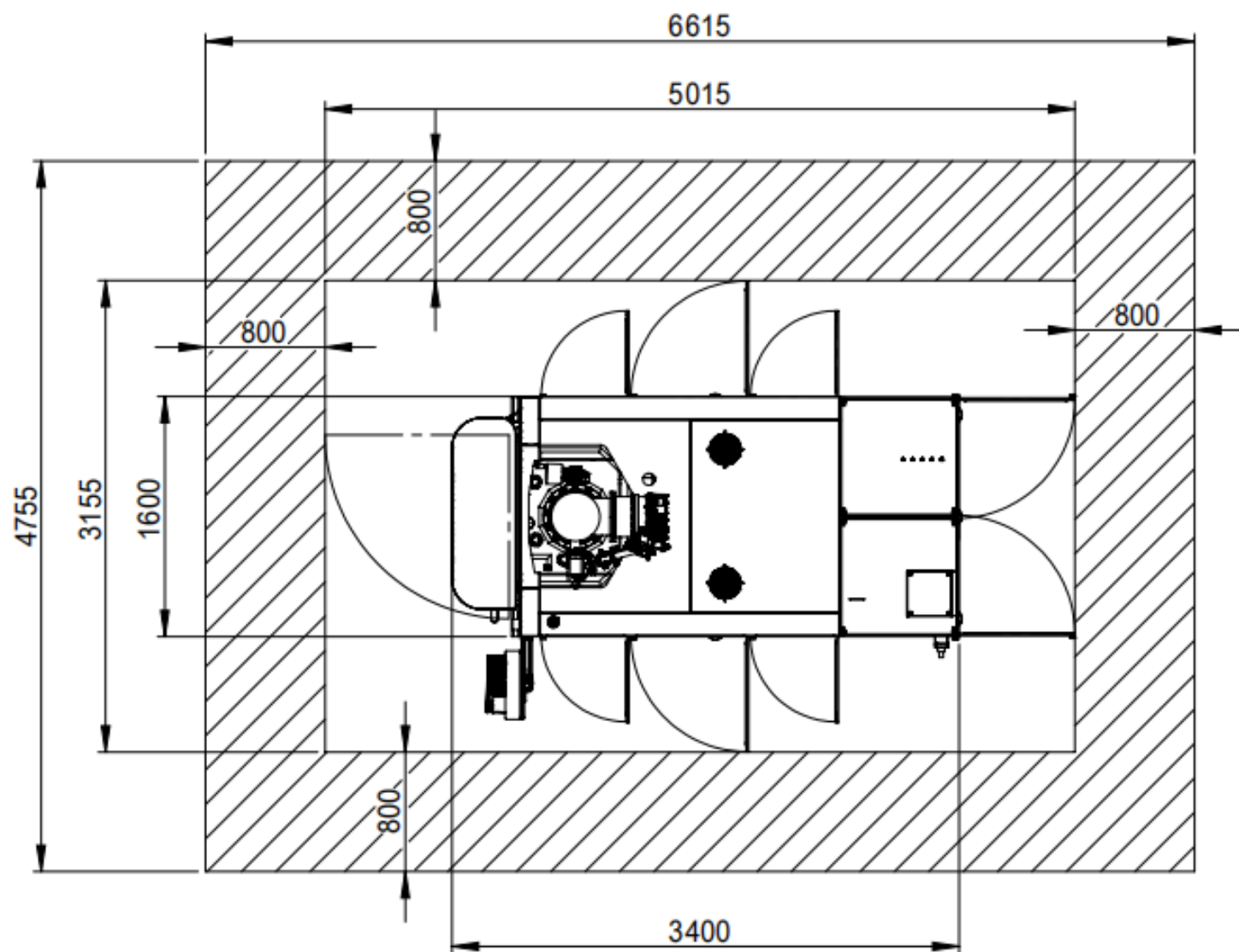
HD500 Layout



HD500布局

- **Non-equilateral pentagonal modular cavity**
- **Filament arc discharge ion source etching module**
- **3 columns (6 in total) of $\Phi 160$ circular multi-arc source modules**
- **DC + HiPIMS cathode module (W100 * 650H)**
- **Three groups of heaters with a total power of 28 kW**
- **Vacuum (molecular pump + Backing pump)**

HD500 Spatial Dimensions

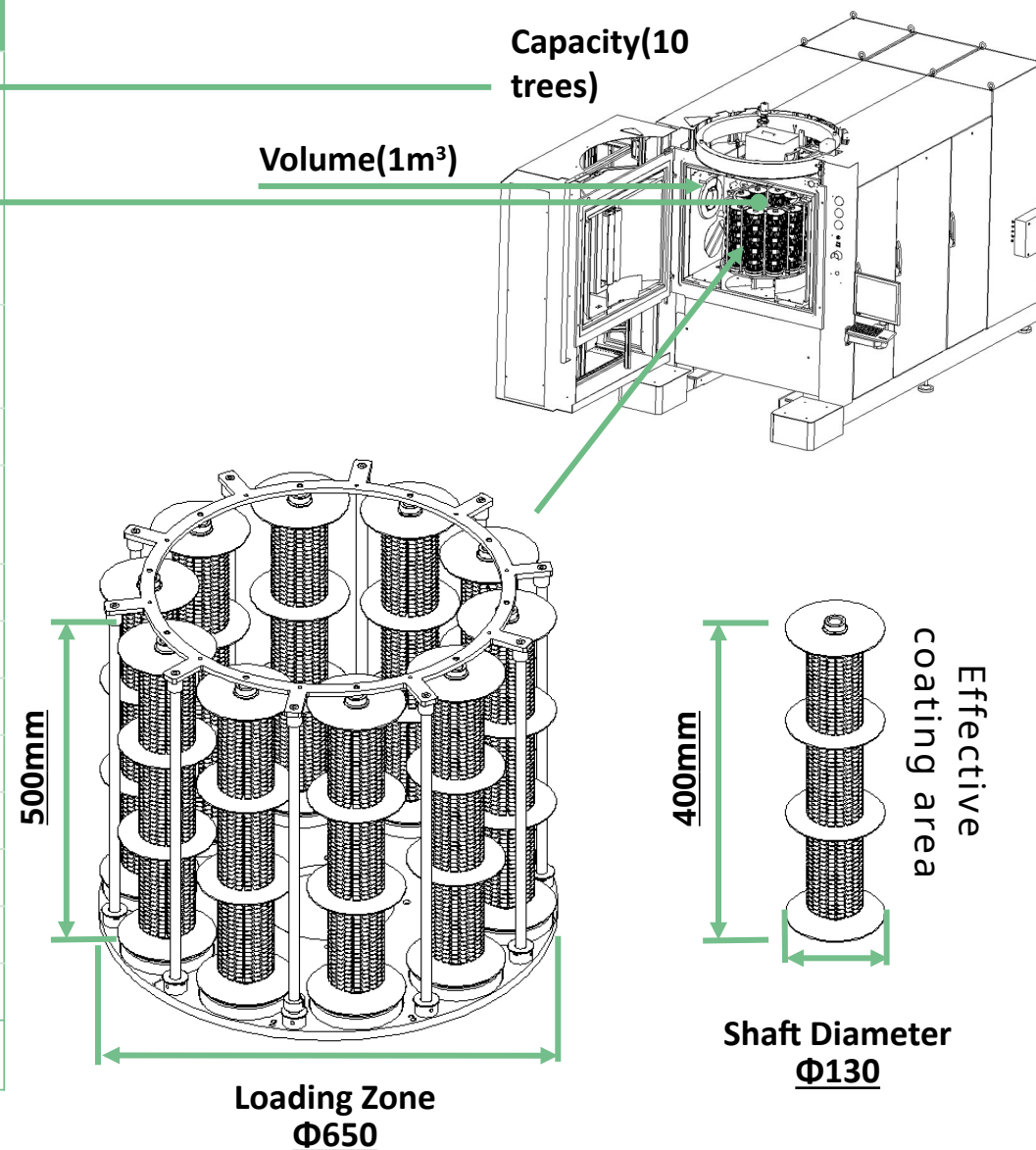


HD500 Electrical Parameters

Model	HD500
Voltage	3*380 (3L+N+PE)
Current	130A
Power	≤85kW
Frequency	50/60Hz
Water Cold22~24°C	5-5.5bar
Compressed air	5-6.5bar
Process gas : Ar/N ₂ /H ₂	1.0-1.2bar

HD800 Parameters

Name	Parameter
	Brand new composite coating technology
Coating technology	
Etching	Lateral ion source (hot filament)
Multi-arc sources (number)	6
Magnetron cathodes (number)	1
Equipment size (mm)	length3750*width2400*height2500
Chamber volume (m ³)	1
Effective coating area (mm)	Φ650*400
Maximum working temperature (°C)	600
Loading capacity (number of trees)	10
Loading capacity of inserts (APMT1135)	12000pcs
Loading capacity of drills (D4*50L)	3600pcs
Maximum loading weight (KG)	300
Shaft diameter	Φ130
Process time	AlTiN : 6~8h



HD800 Layout

01

Octagonal Modular Chamber



02

Filament Arc Discharge Ion Source
Etching Module



03

4 Columns (8 Units) of $\Phi 160$ Circular
Multi-Arc Source Modules



04

DC + HiPIMS Hybrid Cathode Module
(W100mm * H650mm)



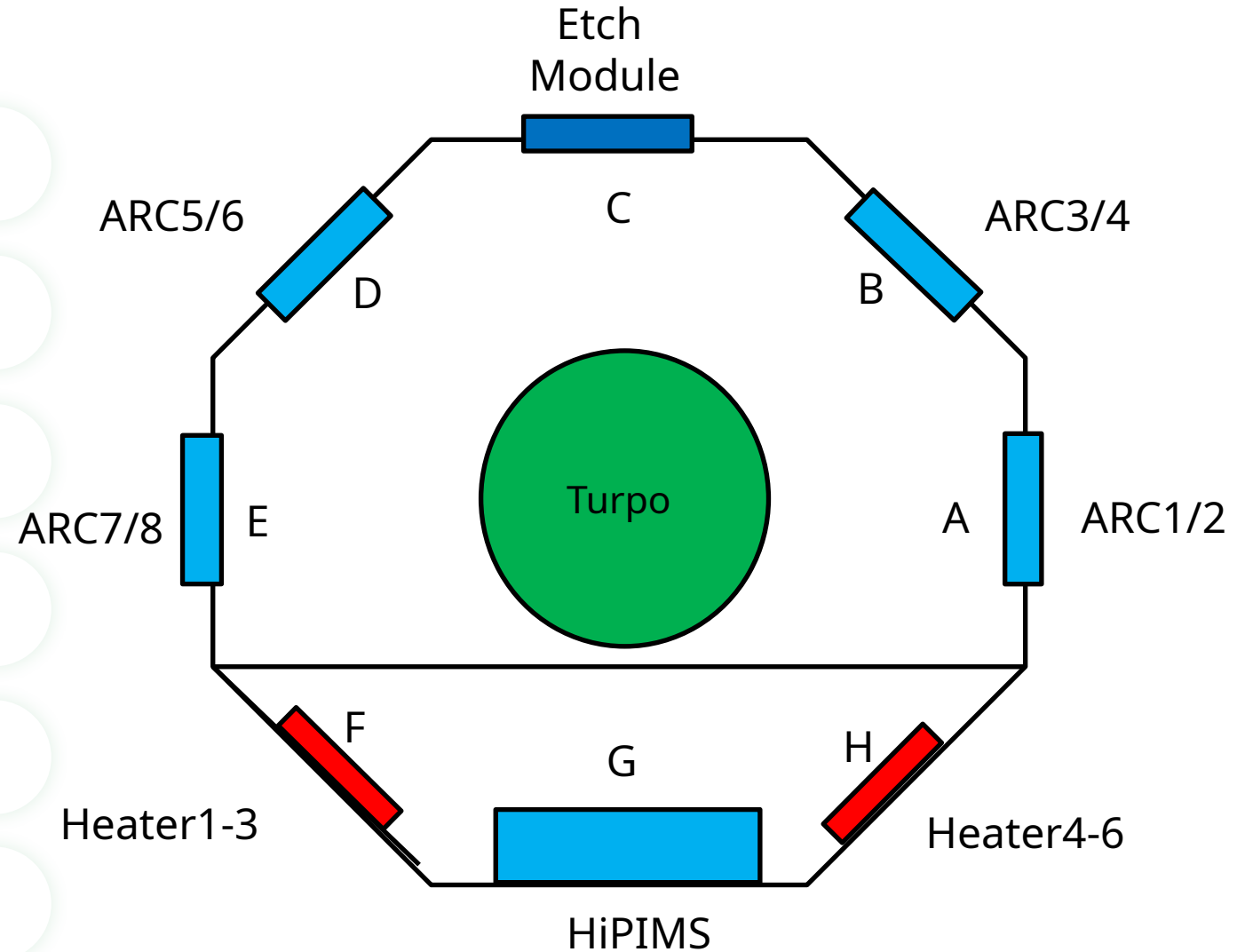
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2 Sets of Heaters, Total Power 30kW

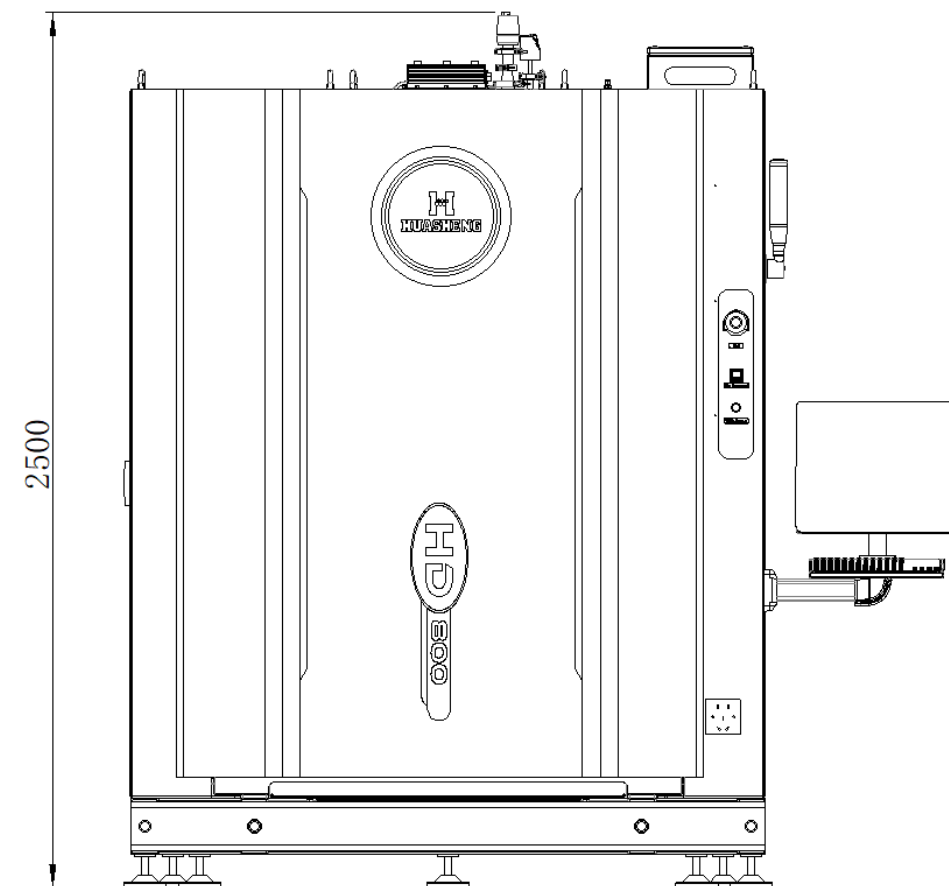
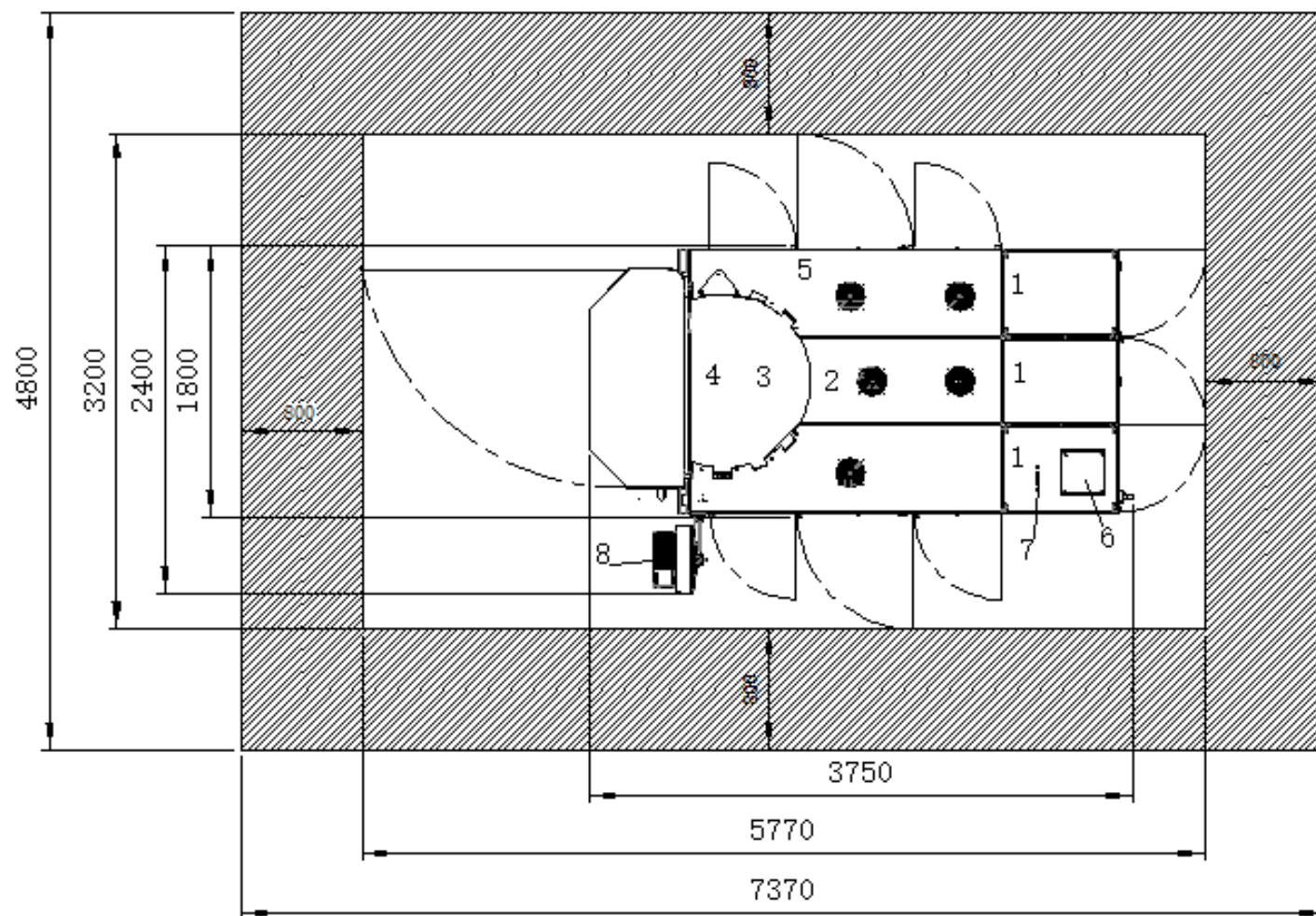


06

Vacuum System (Turbomolecular Pump
+ Backing Pump)



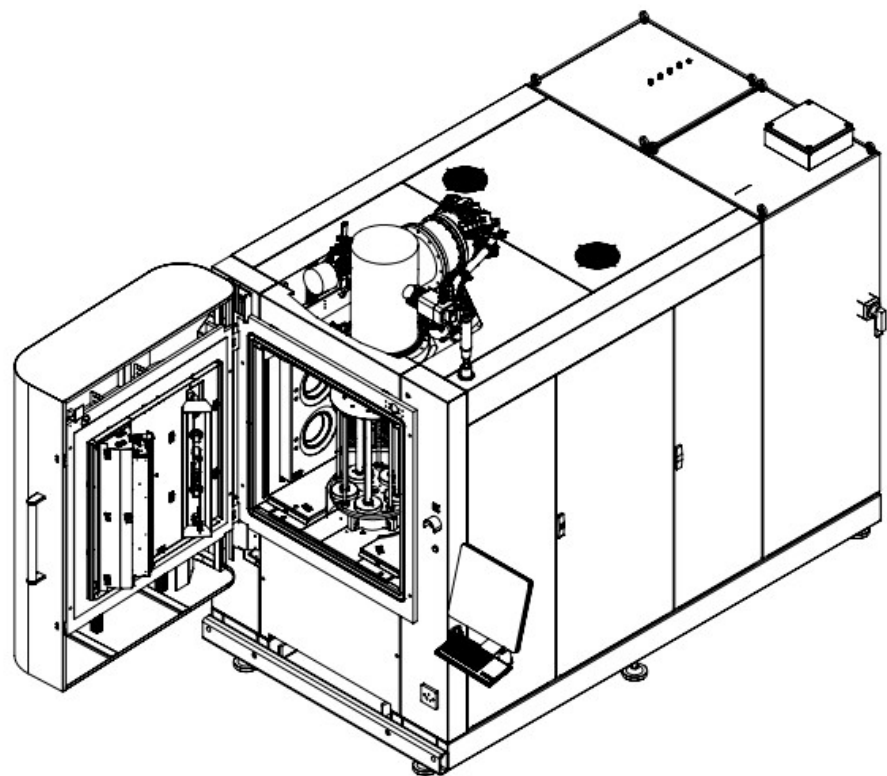
HD800 Spatial Dimensions



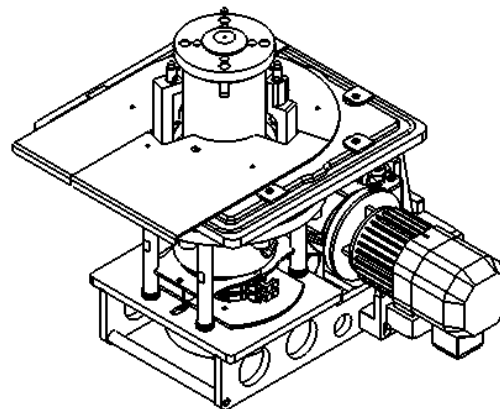
HD Series Equipment Parameters

Model	HD500	HD800
Voltage	3*380 (3L+N+PE)	3*380 (3L+N+PE)
Current	130A	150A
Power	≤85kW	≤85kW
Frequency	50/60Hz	50/60Hz
Cooling Water:22~24℃	5-5.5bar	5-5.5bar
Compressed air	5-6.5bar	5-6.5bar
Process gas : Ar/N ₂ /H ₂	1.0-1.2bar	1.0-1.2bar

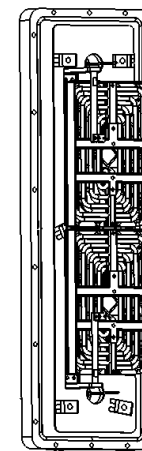
Functional Components



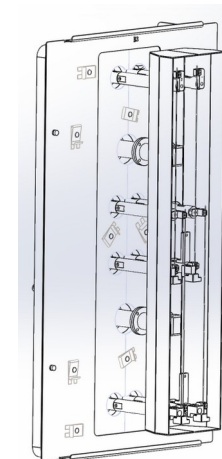
Main body



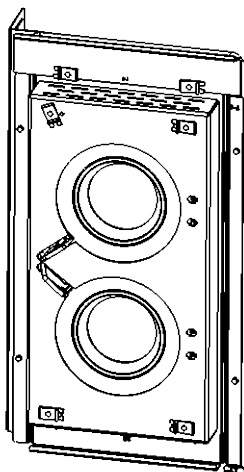
workpiece rack base



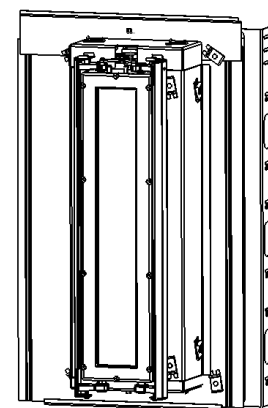
heating module



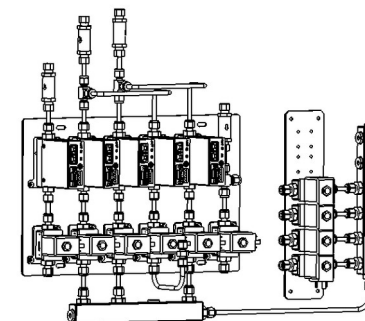
etching module



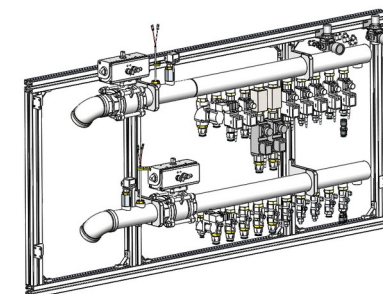
arc module



**cathode
module**

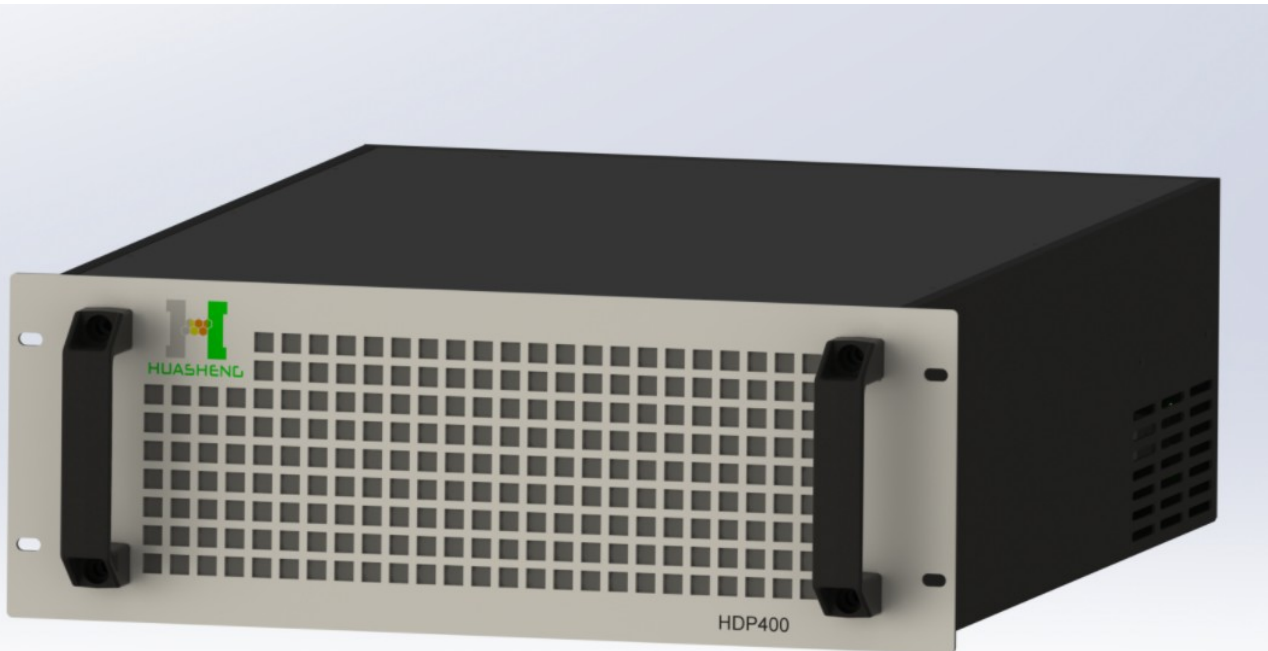


gas line module



water line module

Arc Source Power Supply (HDP400)



Project

Parameter

Power

12kW

Frequency

0.1~500Hz

Duty cycle

5~95%

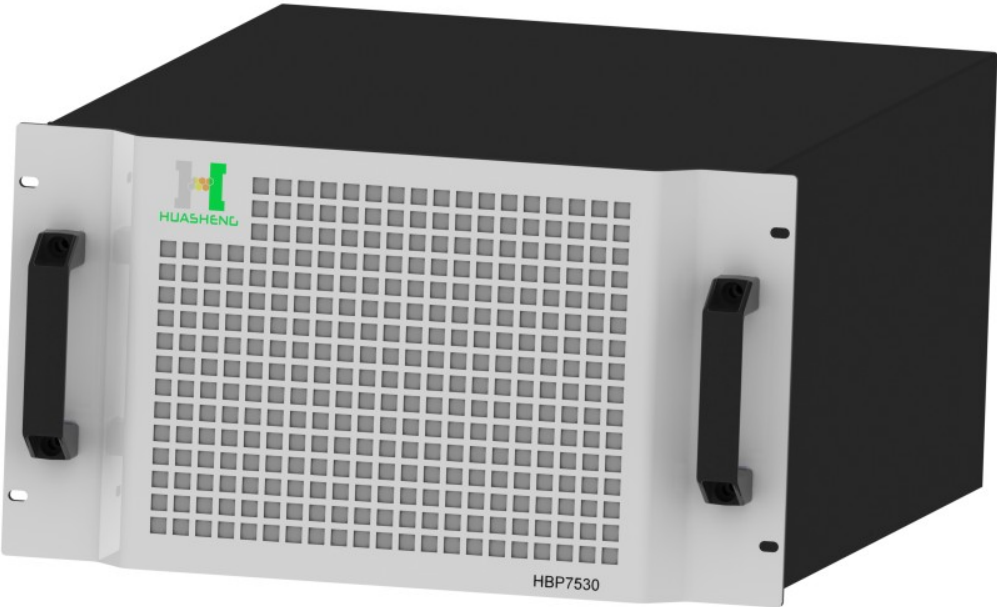
Current

4~400A

Bias Power Supply (Designed and Produced by HUASHENG)



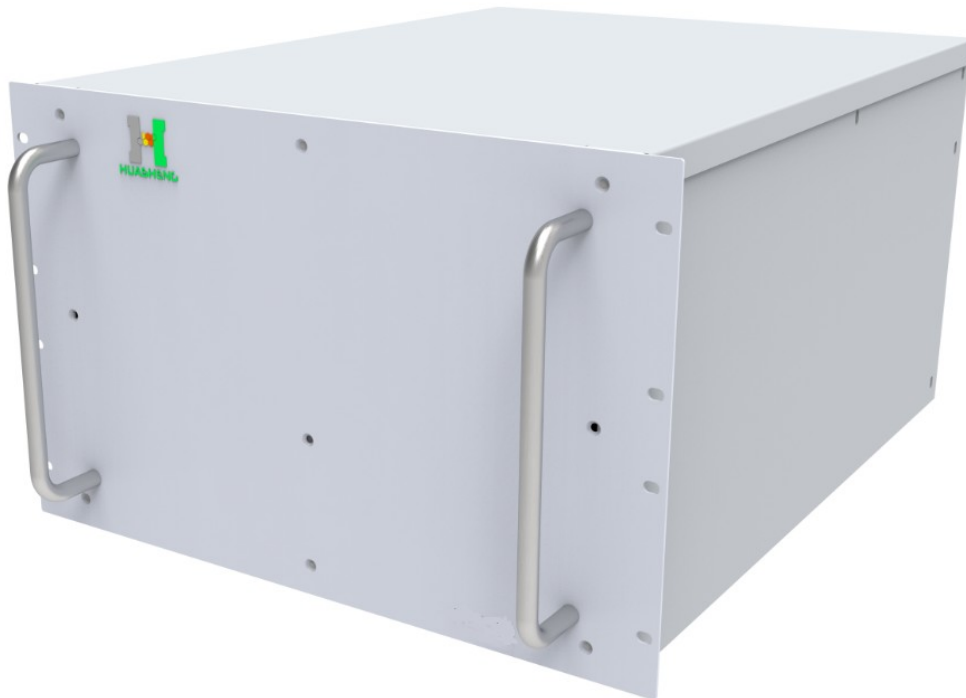
•Constant voltage output, providing negative bias for turntable.	•Make the workpiece clean more thoroughly and improve the adhesion of the film layer.
•During etching, argon ions are accelerated to bombard the workpiece surface.	•By changing the value of negative bias voltage, the film performance can be adjusted.



Project	Parameter
Voltage	20-1000VDC
Power	30kW
Frequency	1~30KHz
Duty cycle	5~95%
Current	400V/75A 1000V/30A

HiPIMS Power Supply (MELEC)

- **Dual Configuration: Equipped with DC + HiPIMS magnetron sputtering sources, combining arc evaporation with magnetron sputtering.**
- **High Deposition Rate: Achieves fast coating deposition while capable of handling refractory metals.**
- **Superior Coating Quality: Produces coatings with excellent surface smoothness and enhanced density.**
- **Adjustable Internal Stress: Enables precise control of internal stress for improved coating performance.**



Project	Parameter
Voltage	1000VDC
Power	20kW
Duty cycle	0~99%
Current	1000A

List of Core Components

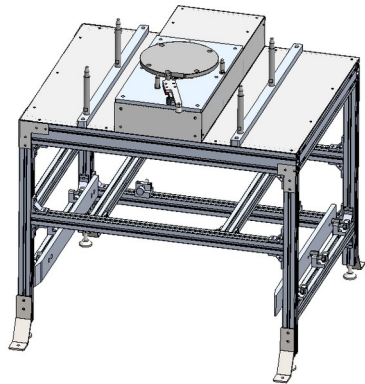
Item	Name	Brand	Quantity	Parameter description
1	Molecular pump	Leybold	1	pumping speed 2200 L s ⁻¹ , limit pressure < 10 ⁻⁸ mbar.
2	Backing pump	FeiYue	1	VRD90+VBP600 (two-stage rotary vane pump + Roots pump combination) pumping speed 600m ³ /h, limit pressure 1x10 ⁻² mbar.
3	Bias power supply	Huasheng	1	HBP7530, 90kW/set, DC Pulse, DC1000V
4	arc source	Huasheng	6	Target diameter160mm , MAG3:Electromagnetic+permanent magnet
5	arc power supply	Huasheng	6	DC Pulse, 10kW, 400A, 500Hz
6	Magnetron Cathode	Huasheng	1	W100*L650*T10mm
7	HiPIMS Power Supply	MELEC	1	power : 20kW
8	flow meter	Sevenstar	4	N ₂ : 2L/1 set, Ar: 1L/1 set,

List of Core Components

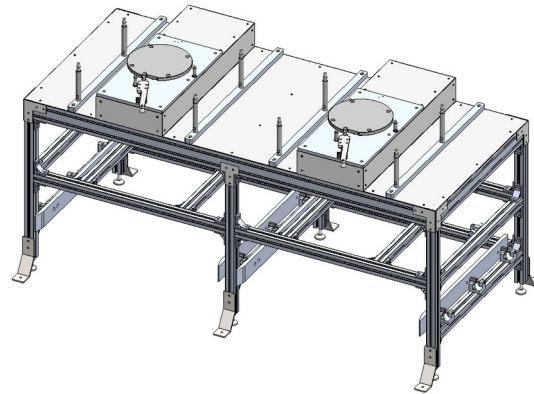
Item	Name	Brand	Quantity	Parameter description
9	IPC	Huasheng	1	Beckhoff PC/PLC, 19-inch touch screen, Siemens appliances
10	Chamber	Huasheng	1	304 stainless steel, indirect water cooling
11	Workpiece transmission system	Huasheng	1	Frequency conversion motor 1~3 revolutions, bearing 300KG, magnetic fluid seal.
12	temperature control system	Huasheng	1	Power/temperature two control modes, double-layer high-density power heater, total power 28kW
13	Vacuum measurement	Inficon	1	Baratron-CDG100D IKR-MPG400 , Pirani-PSG500
14	pneumatic control system	SMC	1	Solenoid valve, cylinder, sensor
15	Cooling control system	NNT	1	Water temperature and flow sensor, pressure sensor

Optional Accessories

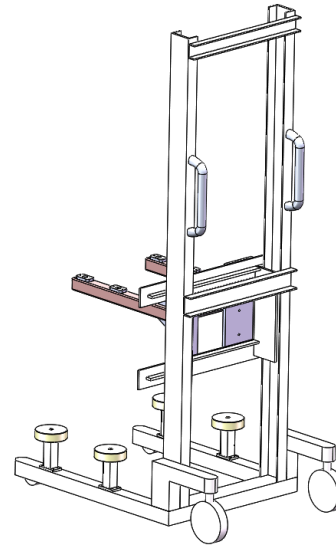
- Work bench for one operator



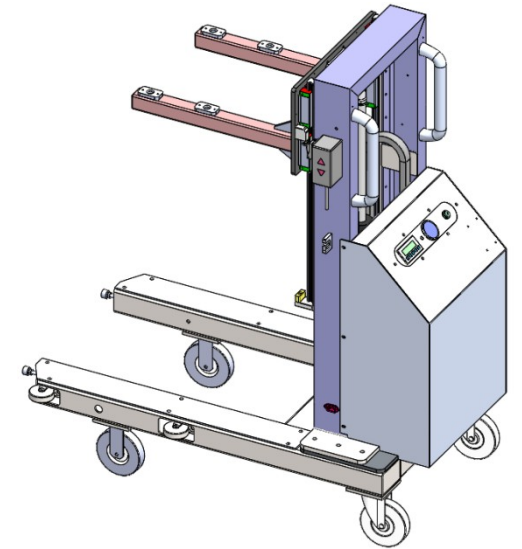
- Work bench for two operators



- Forklift for loading and unloading carousal (manually operated)



- Forklift for loading and unloading carousal (semi-automatic mode)



04

Equipment Process

Universal Coating for Round Tools:HLM

HuaSheng® HLM

Ap
pli
cat
ion

- ◆ Stainless Steel , Cast Iron
- ◆ High-alloy steels and Difficult-to-machine tool steels.
- ◆ High-strength and high-hardness



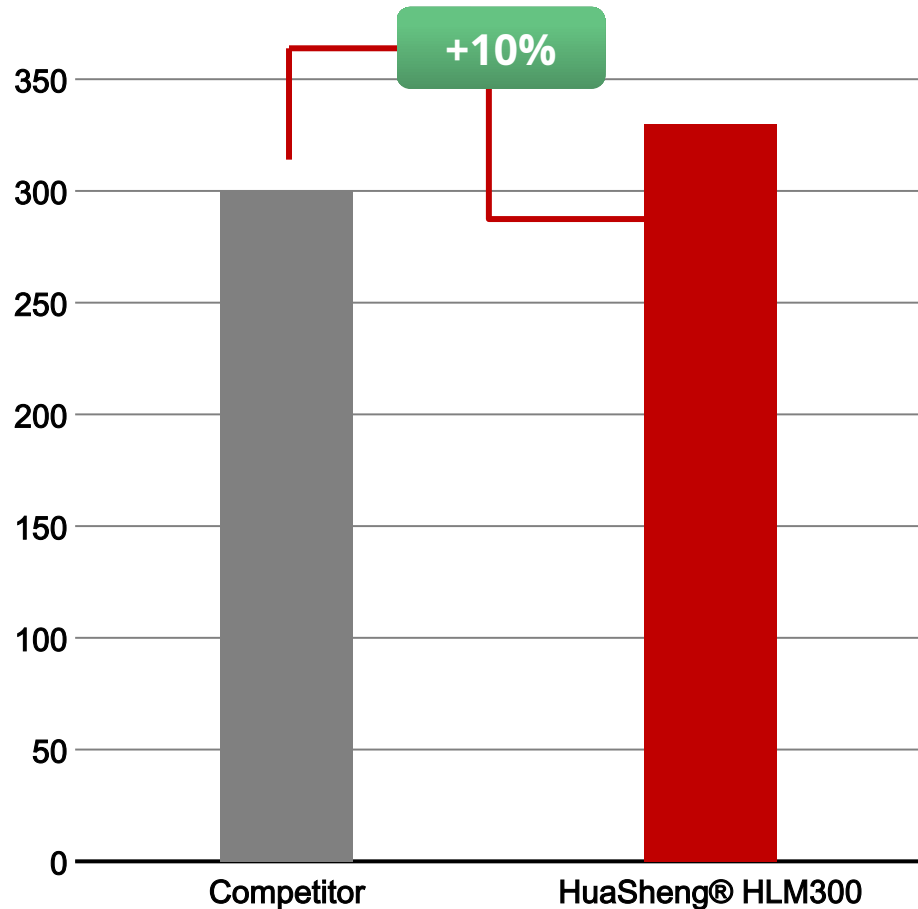
Coating Features	AlTiN
Color	Black
Thickness (μm)	2.5±0.5
Hardness (GPa)	34±3
Stress (Gpa)	-4.0±1
Deposition Tem. ($^{\circ}\text{C}$)	< 500
Max Working Tem. ($^{\circ}\text{C}$)	1100

Coating Structure	Performance
Brand new AlTi-base structure	Enhance coating adhesion strength and refine grain structure
Aluminum-rich	Enhancing thermal oxidation stability and red hardness
Balancing between the stress and thickness	Enabling multi-purpose applications with exceptional durability

Universal Coating for Round Tools:HLM

• Case : 718H Side Milling Roughing

Tool Life/min



Cutting Tool :

- D6 Square End Mill

Workpiece: 718H (35-37HRC)

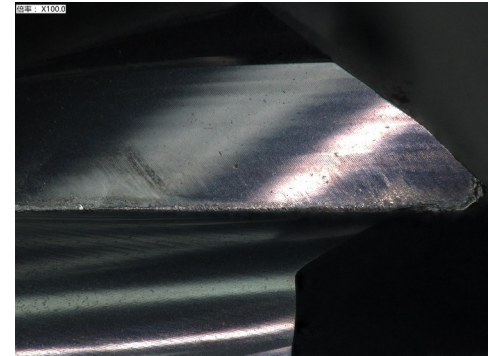
Condition : Side Milling

- $V_c = 218.5\text{m/min}$
- $F_z = 0.05\text{mm}$
- $a_p = 3\text{mm}$
- $a_e = 0.3\text{mm}$
- Cooling : by Air

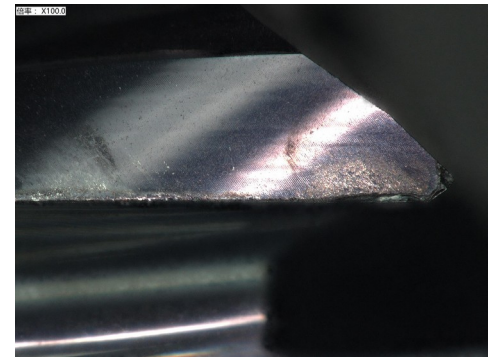
Test Results:

- Tool Life Criterion: Flank wear (V_b) reaches 0.08 mm.
- Huasheng HLM Coating: 330 min
- Competitor Coating: 300 min
- Conclusion: HLM coating delivers a 10% increase in tool life over the competitor

Data Source: Huasheng Laboratory



300min Flank Wear-
HLM



300min Flank Wear-
Competitor

HAP: Specialized Coating for Mild Steel Machining

HuaSheng® HAP

Application

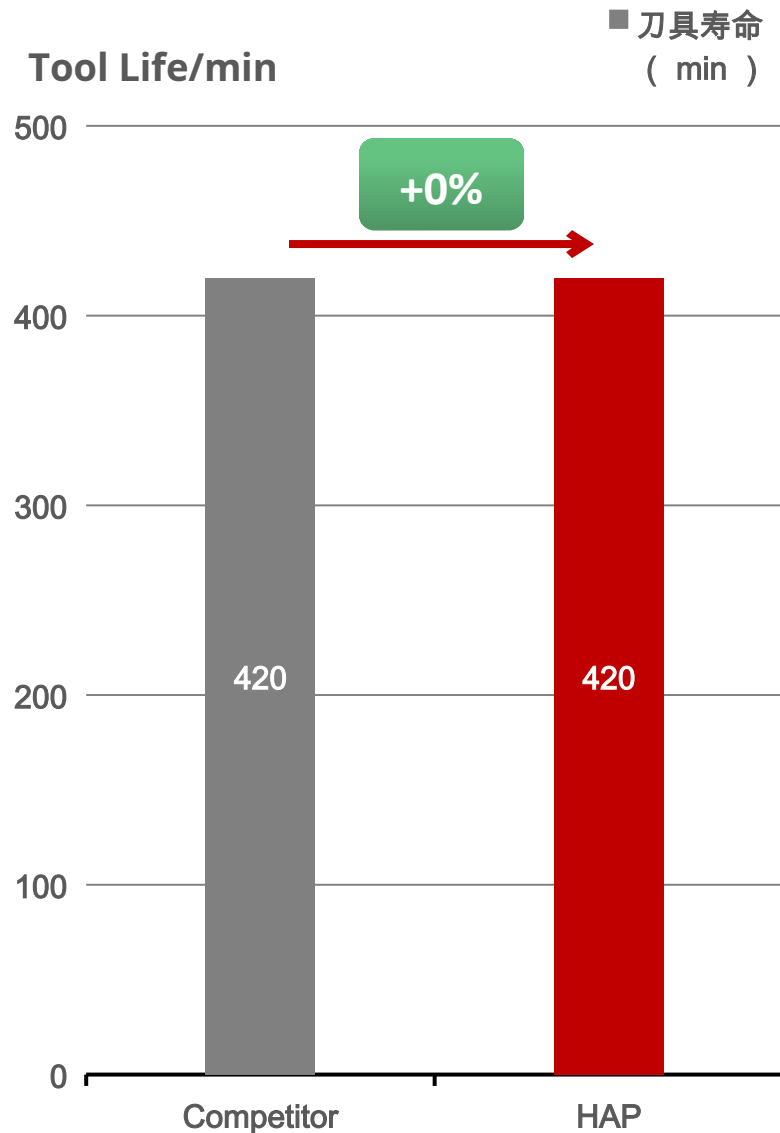
- ◆ Carbon Steel (P20) : 30HRC 、 Air Cooling/Oil Cooling
- ◆ Alloy Steel(Cr12MoV) : 48HRC 、 Air Cooling/Oil Cooling



Coating Features	AlCrN
Color	Grey Balck
Thickness (μm)	2.5±0.5
Hardness (GPa)	34±3
Stress (Gpa)	-3.5±1
Coating Tem. ($^{\circ}\text{C}$)	< 500
Max. Working Tem. ($^{\circ}\text{C}$)	1100

Coating Structure	Performance
Brand new AlCrN composite structure	Enhance coating adhesion strength and refine grain structure
AlCr-base AIP coating	Enhancing thermal oxidation stability
AIP+DC+HIPIMS tech	Minimize coating residual stress,enhance coating tribological performance

HAP: Specialized Coating for Mild Steel Machining



Cutting Tool : D6*L50*F4

workpiece:718H (35~39HRC)

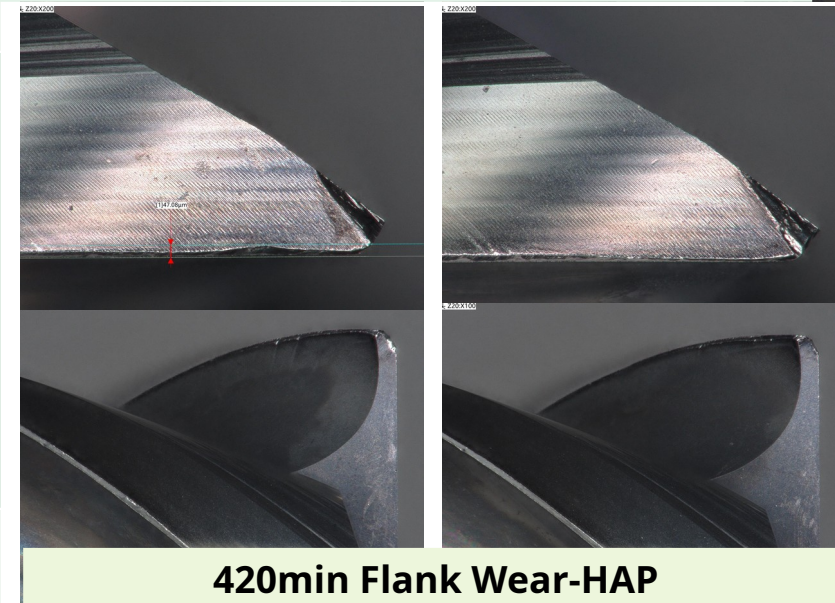
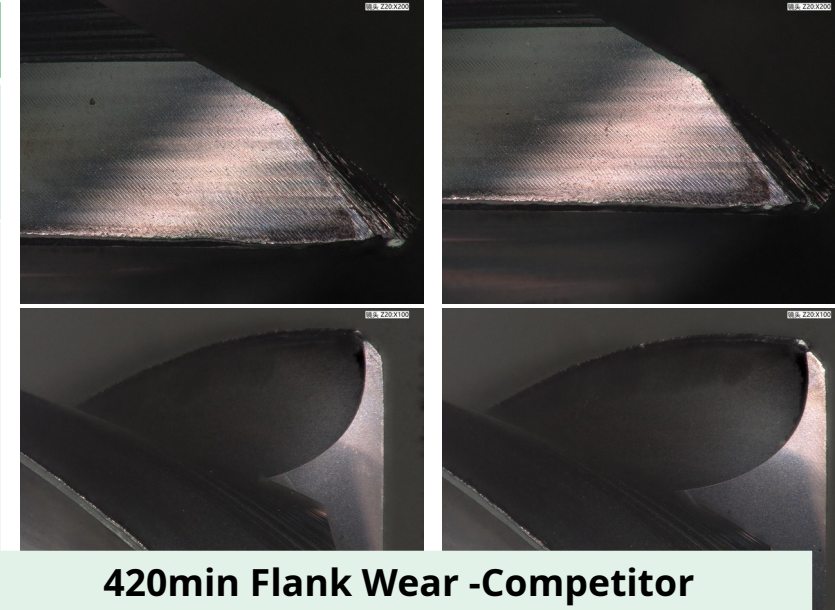
Condition : Milling

- $V_c = 144$
- $F = 0.07 \text{ mm/z}$
- $a_p = 7.5 \text{ mm}$
- $a_e = 0.3 \text{ mm}$
- Cooling : oil cooling

Test Results:

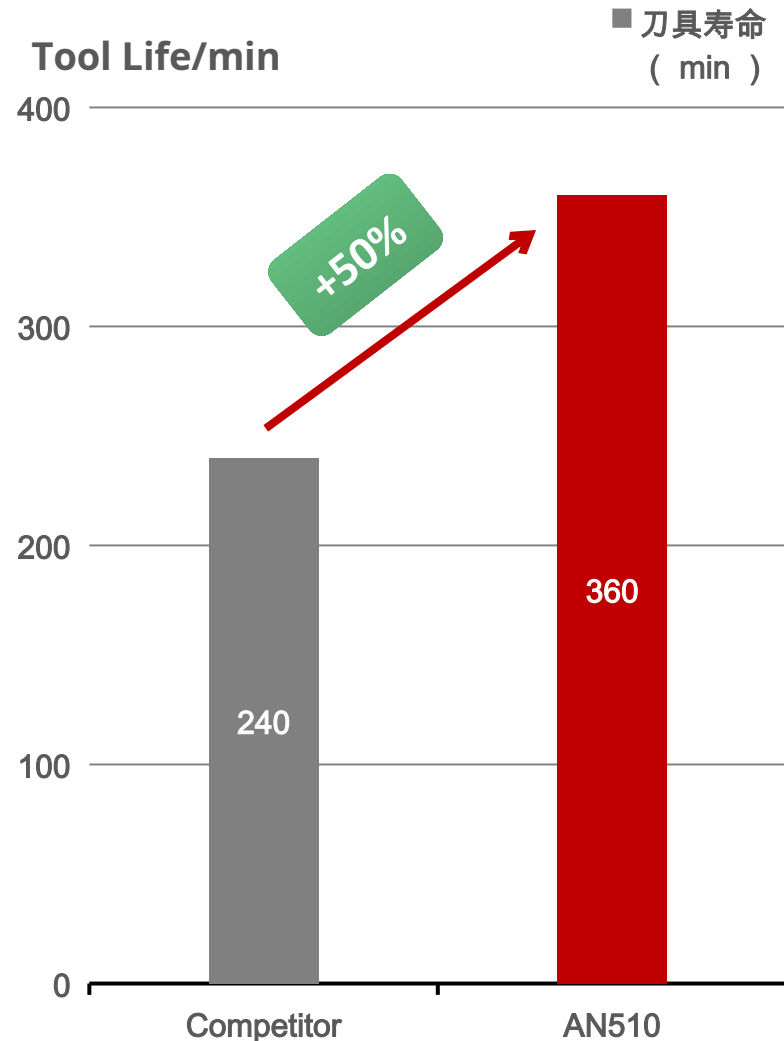
- Tool Life Criterion: Flank wear (V_b) reaches 0.05 mm.
- HAP coating achieved 420 min, matching the performance of the leading competitor. Superior edge integrity observed on HAP-coated tools at identical cutting intervals

Data Source: Huasheng Laboratory



HAP: Specialized Coating for Mild Steel Machining

- Significant Advantages in Wet/Emulsion Cooling Conditions



Cutting Tool : D6*L50*F4

Workpiece:718H (35~39HRC)

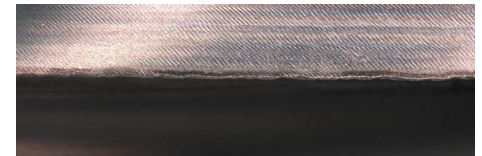
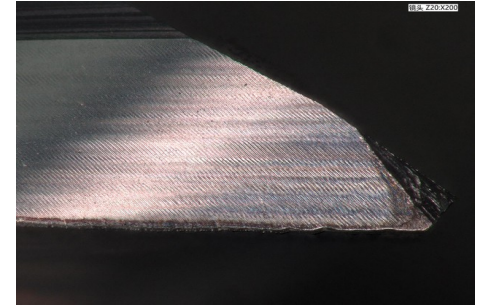
Condition : Milling

- $V_c = 144$
- $F = 0.07 \text{ mm/z}$
- $a_p = 7.5 \text{ mm}$
- $a_e = 0.3 \text{ mm}$
- Cooling : Emulsion Cooling

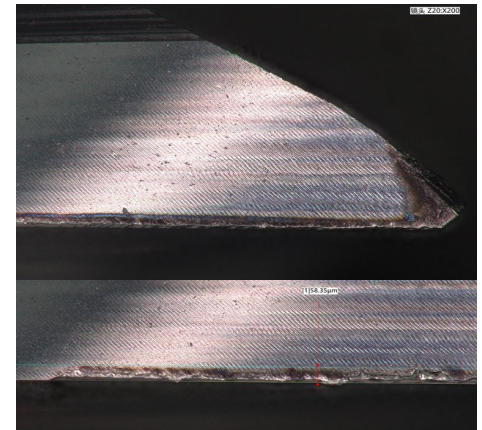
Test Results:

- Tool Life Criterion: Flank wear (V_b) reaches 0.05 mm
- HAP Coating Tool Life: 360 min
- Competitor Coating Tool Life: 240 min
- Conclusion: 50% Performance Improvement

Data Source: Huasheng Laboratory



240min Flank Wear
(24 μm)-HAP



240min Flank Wear
(50 μm)-Competitor

HDR: Specialized Coating for High-Hardness Steel Milling

HuaSheng® HDR

Application

◆ High-Hardness Steel(SKD11) :
58-62HRC 、 Air Cooling

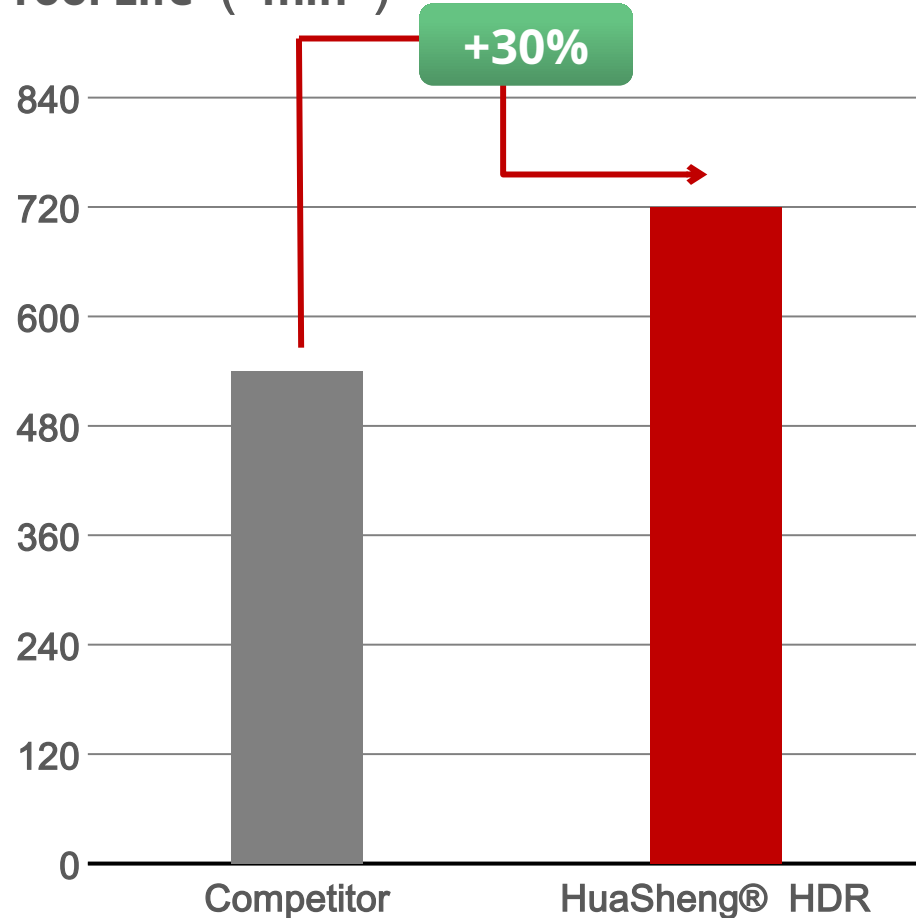


Coating Features	AlTiSiN-base
Color	Bronze
Thickness (μm)	2.5±0.5
Hardness (GPa)	36±3
Stress (Gpa)	-5.5±1
Coating Tem. ($^{\circ}\text{C}$)	< 600
Max. Working Tem. ($^{\circ}\text{C}$)	1200
Coating Structure	Performance
Brand new AlCrTiXN comppsite design	Enhance coating adhesion strength, disrupt dendritic crystal growth, and refine grain structure
AlCr-base AIP coating	Improve adhesion strength and oxidation resistance
AIP+DC+HIPIMS tech	Reduce coating residual stress and enhance tribological performance

HDR: Specialized Coating for High-Hardness Steel Milling

• Case 1 : S136 (52HRC)

Tool Life (min)



Cutting Tool :

- D6R3*9*50*d6

Workpiece:

- S136 (52HRC)

Condition : Bottom Milling

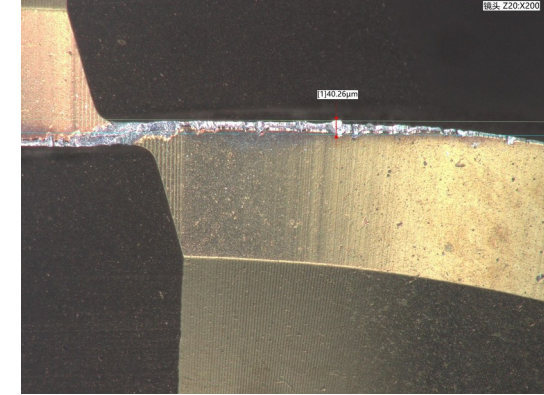
- $V_c = 179\text{m/min}$
- $F_z = 0.1\text{mm/z}$
- $A_e = 0.07\text{mm}$
- $A_p = 0.04\text{mm}$
- Cooling: Water Cooling

Test Results :

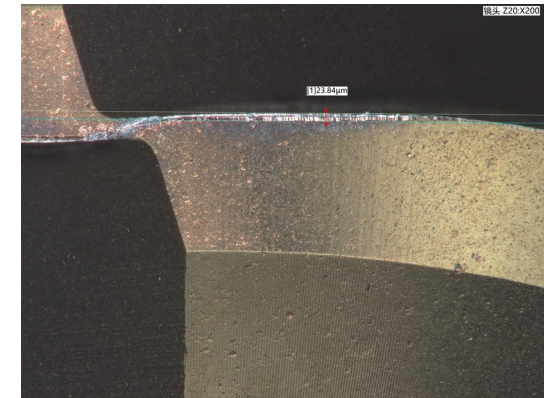
Tool Life Criterion: Flank wear (V_b) reaches $50\mu\text{m}$

- BDR Coating Tool Life: 540min ;
- HDR Coating Tool Life: 720min ;
- Conclusion: 30% Performance Improvement.

Data Source: Huasheng Laboratory



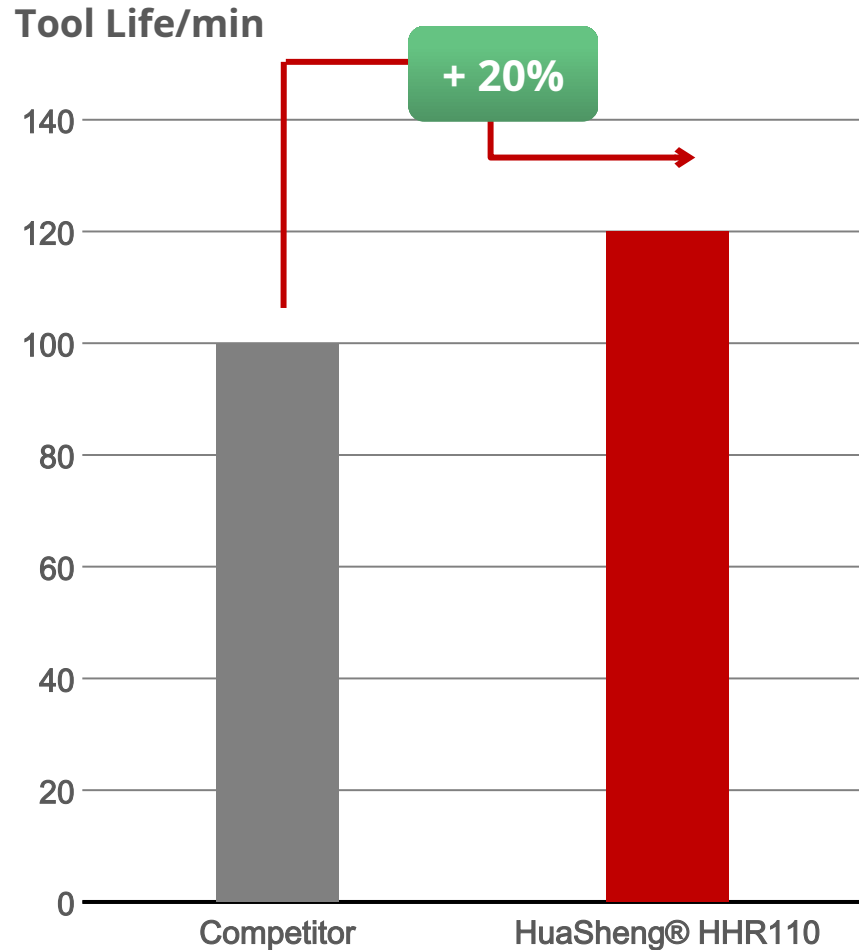
360min Flank Wear
($50\mu\text{m}$) Competitor



360min Flank Wear
($23\mu\text{m}$) HDR

HDR: Specialized Coating for High-Hardness Steel Milling

• Case 2 : High-Hardness Steel(SKD11) Milling



Cutting Tool :

- D6R3*50 Ball nose End Mill

Workpiece: SKD11 (58-62HRC)

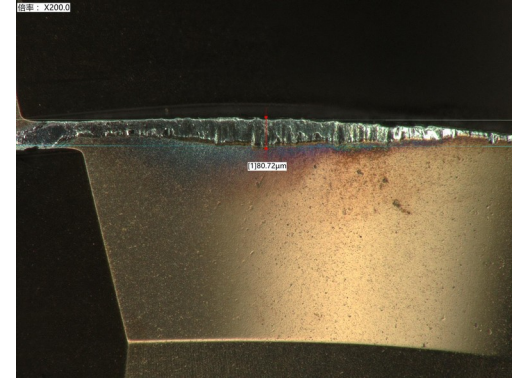
Condition : Milling

- $V_c = 141\text{m/min}$
- $F_z = 0.033\text{mm}$
- $a_p = 0.15\text{mm}$
- $a_e = 0.3\text{mm}$
- Cooling: Air Cooling

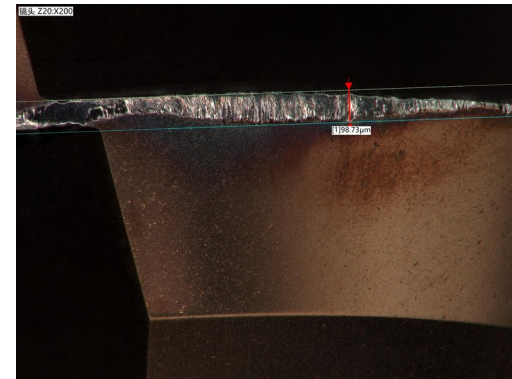
Test Results :

Tool Life Criterion: Flank wear (V_b) reaches $100\mu\text{m}$

- HDR Coating Tool Life: 120min ;
- BDR Coating Tool Life: 100min ;
- Conclusion: 20% Performance Improvement



100min Flank Wear($80.72\mu\text{m}$)-HDR



100min Flank Wear($98.73\mu\text{m}$)-Competitor



Your Ideas, Our Solution

THANKS