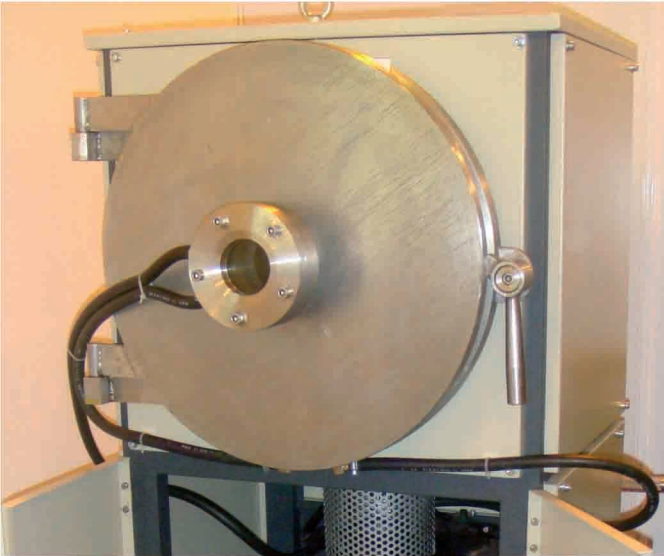


PLASMA ASSISTED CHEMICAL VAPOR DEPOSITION

Robust, Economical and Flexible instruments
for Tribological Coatings



Plasma Fanavar Amin Company (PFA Co.), an industrial and research company, was founded in 2007. The main activities of this company is design and manufacture of Plasma Vacuum Deposition systems and power supplies with surface engineering applications. PFA is Designer and manufacturer of plasma nitriding and Plasma Assisted Chemical Vapour Deposition (PACVD) equipments and vacuum furnace in laboratory and industrial scales, DC and Pulsed DC rectifiers for electroplating, specially for nano-composite layers. Also vacuum coating and surface engineering consultancy services are available.



Applications

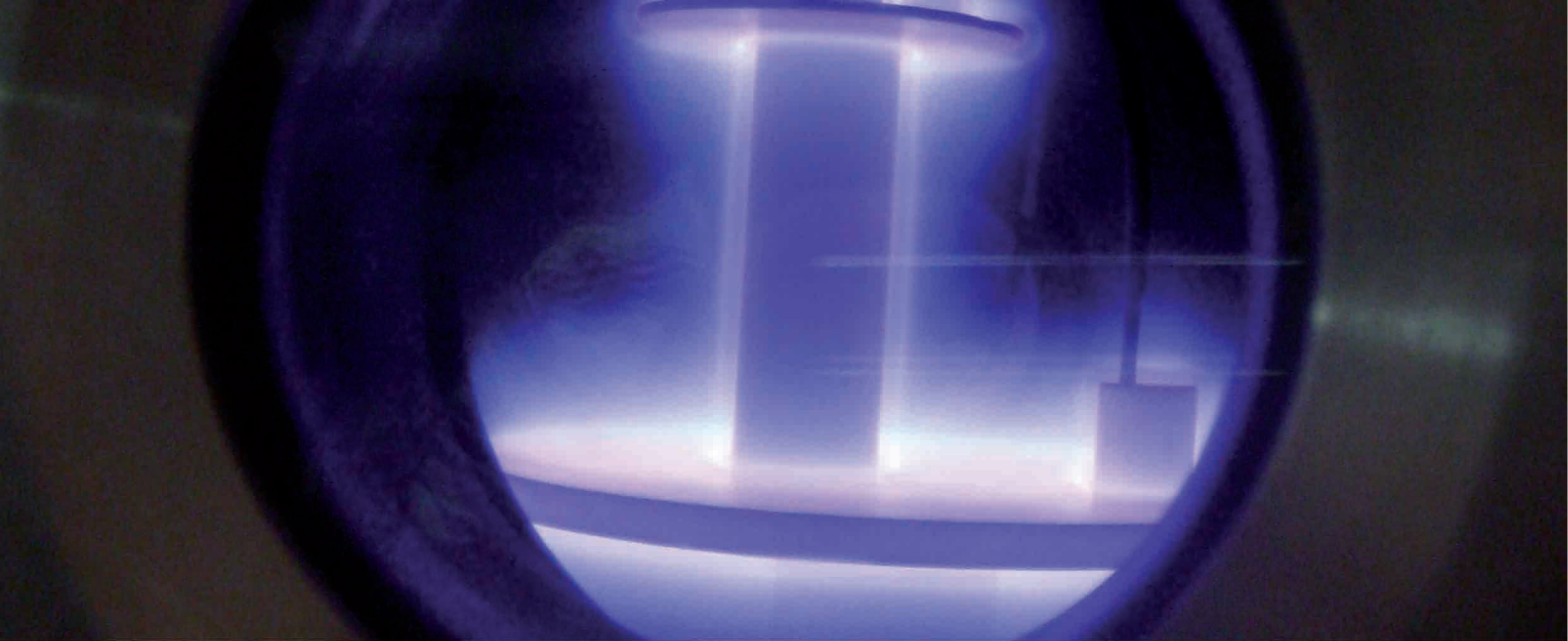
Increase durability, reduced release agent requirement and extension of working life about 500% in

- Casting molds
- Extrusion Dies
- Plastic molds
- Forming tools
- Cutting tools
- Tools Coating
- Automotive components
- Decorative
- R&D

Plasma Assisted Chemical Vapor Deposition (PACVD) systems

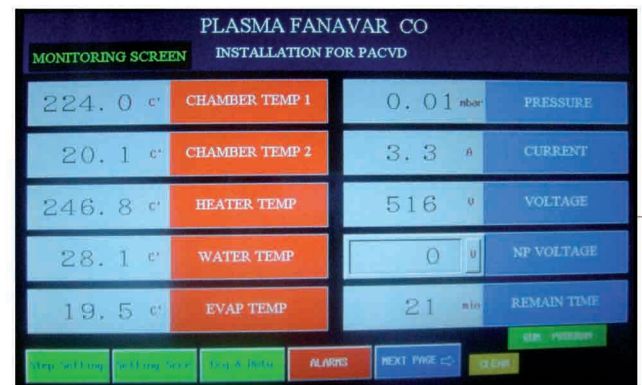
PFA (PACVD Series) coating systems have been developed to combine the good adhesion of CVD and the low temperature of PVD, while avoiding their typical shortcoming. These coating systems are used to deposit smooth, well adhered TiN, TiAlN, TiCN, DLC and similar hard coatings in a low vacuum environment at temperature around 500 °C , meaning a wide range of materials can be coated.

These coating systems are applied on cutting tools to extend the lifetime of the tools many times over. The choice of coating is depending on the kind of tool and its use. With more than 20 years of experience, Plasma Fan will offer expert advice to choose the most effective coatings for your purpose, such as TiN, TiCN, AlTiN, CrN, AlCrN and DLC Coatings.



FEATURES

- Precise repeatability
- Simple, efficient and partial Cold and Hot wall Plasma Nitriding
- Possibility of sputtering before coating
- Uniform coating thickness distribution, even with complex shapes
- Smooth surfaces, no need to any postprocessing
- Lower friction coefficient
- Applicable for all varieties of steels and other metals
- Highest wear and corrosion resistance
- User friendly parameters input and visualization
- Reliable process control by independent PLC
- Quick and easy loading

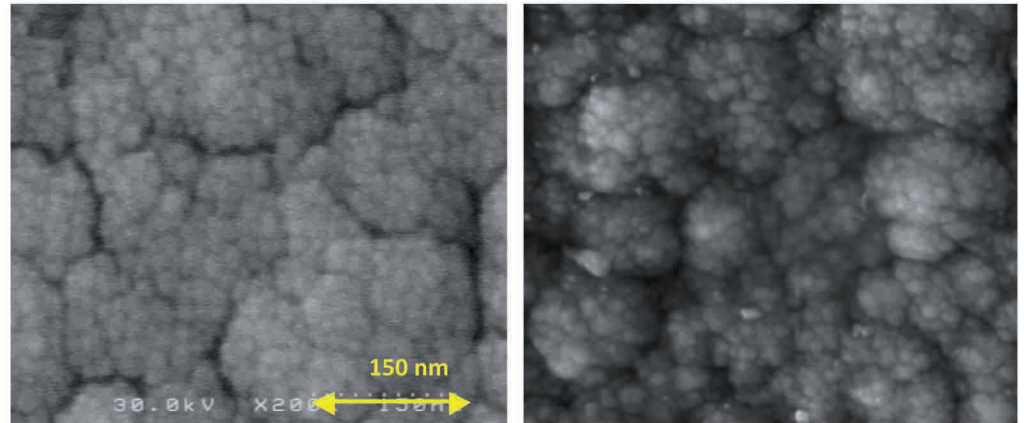


Process Controller

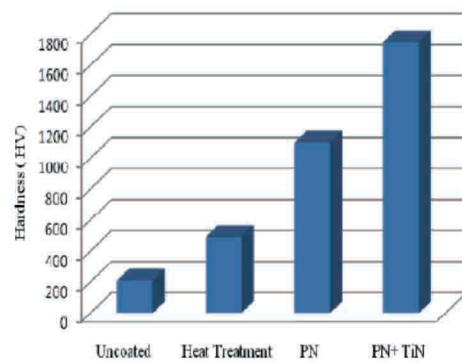
Technical Specifications

Specifications of PFA - PACVD equipments	Small Scale For Researches	Medium Scale For R&D	Large Scale For Industries
Maximum voltage, current	800 V, 10 A	900 V, 30 A	1000 V, 50 A
Duty cycle	20 - 80 %		
Output frequency	2 -10 kHz		
Working pressure	0.5 – 8 mbar		
Minimum pressure	5×10^{-2} mbar		
System controller	PLC, HMI Unit		
Vacuum chamber dimensions	Outside:50 cm	Outside:90 cm	Outside:110 cm
	Inside:40 cm	Inside:80 cm	Inside:95 cm
	height :60 cm	height:100 cm	height:150 cm
	Stage :20 cm	Stage:70 cm	Stage:85 cm
Chamber material	Stainless steel		
Chamber position	Horizontal	Vertical with Mechanical lifter	
Vacuum pump, gage	Rotary pump, Pirany		
Evaporation chemical liquid	$\text{TiCl}_4, \text{AlCl}_3, \text{BCl}_3, \dots$		
Treatment gases	$\text{N}_2, \text{H}_2, \text{Ar} \text{ \& } \text{CH}_4$		
Temperature control	Automatic		
Gas mixing	Manual-Automatic	Automatic	
Maximum Ttemperature	600 °C	700 °C	

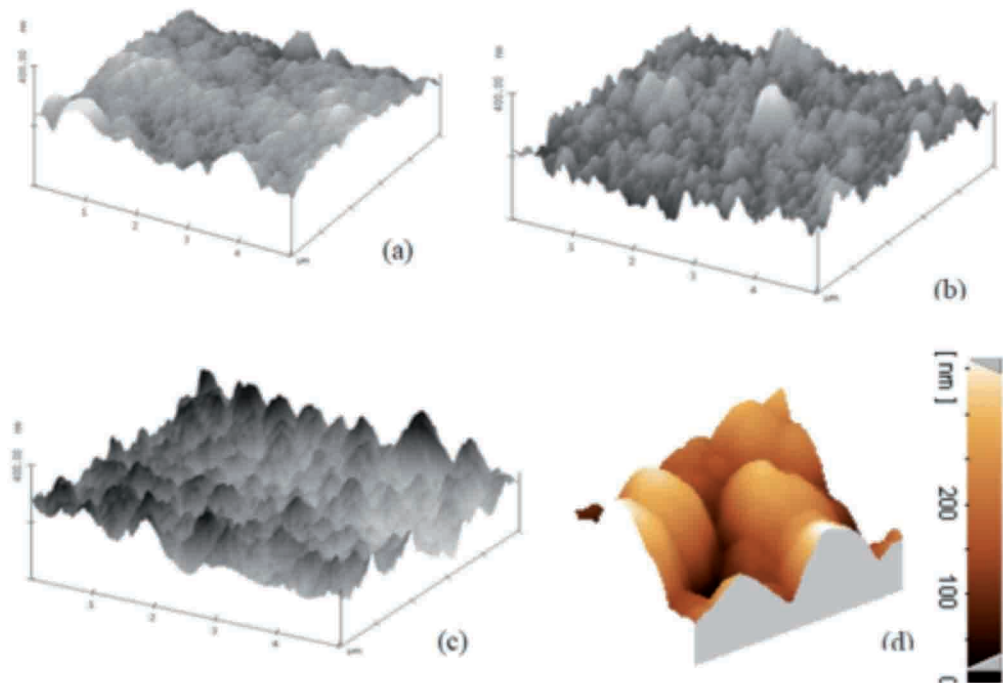
” Results



FESEM(Left) and SEM(Right) images of TiN Coating deposited by PFA-PACVD system



The Surface Hardness for different samples coating by PFA-PACVD system



AFM images of TiN coatings for several duty cycles deposited on H11 steel at 520 °C

SPECIFICATIONS

Specifications of Process and Coats	
Available process	Plasma nitriding & plasma assisted chemical vapor deposition
Available coating and surface treatment	TiN, TiC, TiCN, TiAlN, TiBN, DLC, ...
Suitable substrate materials	Steels and metallic materials
Treatment temperature	450 – 700 °C
Coating thickness	3 – 6 µm (uniform coat)
Grain size	4 – 80 nm
Multi layer	Enable
Coating hardness	Upper than 2000 vickers



These gold-colored TiN coatings, applied with the PACVD process are very hard and chemically inert. Consequently, they are especially suitable for applications associated with tool manufacture and the processing of plastics.

Tools Name	Number of components produced by uncoated tools	Number of components produced by TiN coated tools
Peugeot jackshaft Shaper	100	1550
Peugeot crown wheel hub	180	360

Number of component produced by uncoated tools compare with number of components produced by TiN coated tool (by PFA-PACVD system)