

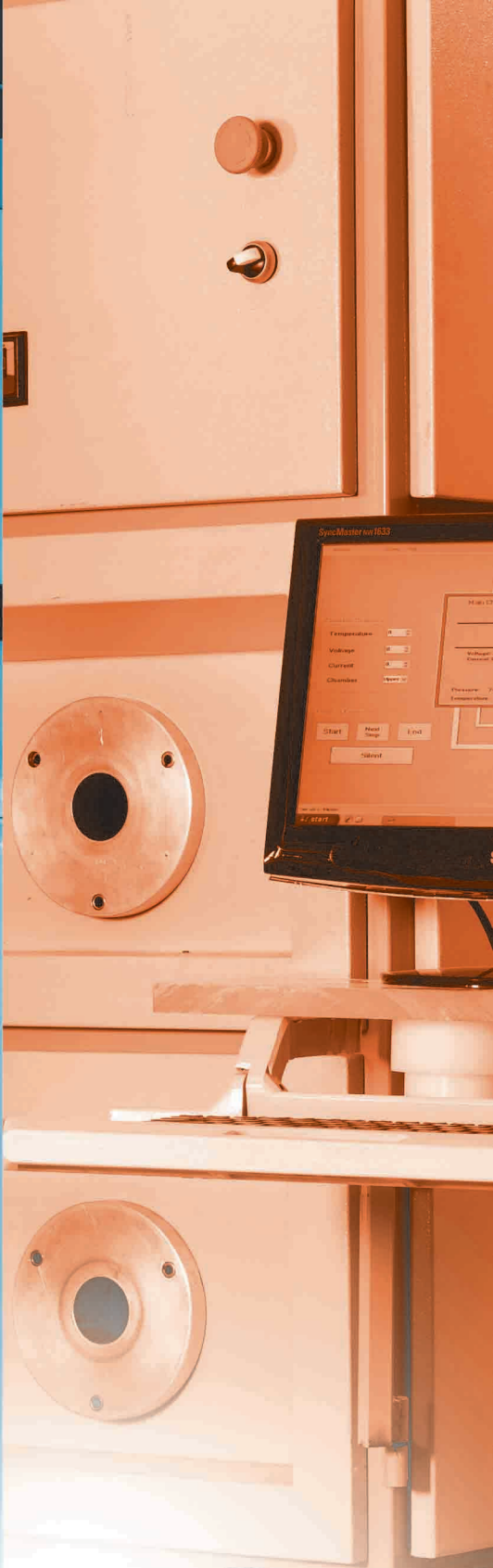
# LPCVD



# DRIE



# PECVD





## about

Toseye Heshgarsazan Asia (Sensiran) is an industrial and research company was founded in 2001 in Technology Pardis Park in Boomhen, Tehran, Iran. This is a knowledge-based company which relies strongly on the development of laboratory facilities as well as conventional sensors for gas and flow detection. In 2008, we introduced our first direct-current plasma enhanced chemical vapor deposition (PECVD) unit called as PE-800 for the growth of carbon nanotubes and nanostructures. This unit was upgraded to PE-802 and PE-803 where more deposition reactors were integrated to improve the performance of the unit. Later on the first version of low-pressure CVD (LPCVD) called as LP-80 was introduced, which allows the growth of polysilicon, silicon-nitrides and silicon nanowires. The unit has been adjusted to hold a high safety standard both in terms of the gas handling unit as well as the main reactor.

Deep Reactive Ion Etching (DRIE) is a breath-taking unit to realize high aspect ratio features on silicon substrates both at micro and nano-scale. An experienced operator is able to obtain unique three-dimensional features using this sophisticated machine. Although the origin of this unit goes back to 2006, it was first inaugurated in 2010.





# company HISTORY

time line

2001	2006	2006	2008	2010	2012
Foundation	LPCVD systems	RIE systems	PECVD systems	DRIE systems	Quality managment system implementation

## Technological support

On-site technical training of the customer experts is included to the commercial offer. Enhanced process training, including development and implementation of processes, can be provided optionally.



## Products

- DC & RF - Plasma enhanced Chemical Vapour Deposition.
- Low Pressure Chemical Vapour Deposition
- Deep Reactive Ion Etching System (DRIE)

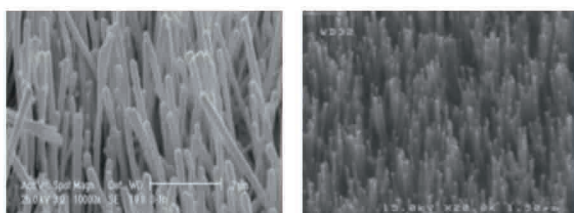
## Plasma Enhanced Chemical Vapor Deposition (PECVD) systems PECVD (SI-PE80):

PECVD unit is a highly specialized piece of equipment for the realization of carbon nanostructures, carbon nanotubes and nano-structure fabrication. SI-PE803 is a newly developed collection of three reactors, which enables the user to program the growth process by means of computerized control over the growth parameters such as temperature, pressure, plasma power (if needed) and the sequence of the gas inclusion into the system.

The evolution of various features in the growing layer depends on the status of the system, which can be quickly switched to a different state. The operating temperature of each reactor can be set between 500 and 850 °C for different applications.

Apart from standard growth, which is expected from a CVD reactor, this piece of equipment can be used as a reactive ion etching unit for hard-to-etch substrates such as SiC.

The standard unit comes with two lines of hydrogen and acetylene, although it can be upgraded by adding one or two more MFCs to include other gases, such as oxygen, NH<sub>3</sub> or Ar as a carrier gas. To add to the safety of the equipment, an isolated transformer is exploited to reduce of electric shock to the user. In addition, door-locks are used to further reduce safety hazards.



FESEM Images of CNTs synthesis by DC-PECVD(SI-PE803)



## ” Specifications

Model	PECVD (SI-PE803)	
Process chamber	Chamber Type & Size	Quartz tube reactor (3 off), 800mm in length
	Useful heat zone	200 mm in the middle of reactors
	Operating Temperature	500-850°C for different applications
Gas Module	Gas Distribution	Two mass flow controllers, SS lines Gas Ring, Main valve, Vacuum gage, Necessary connections, Up to 6 Gas Line
	Gases	Acetylene, Ammonia, Hydrogen, Oxygen, Argon(carrier gas), etc
Pumping System	Vacuum Pumping Systems	rotary vane pump
	Base Pressure	Around 80 MiliTorr depended on processes
Control Module	Industrial PC/PLC	User Friendly windows7 Operator Interface-Temperature control unit
Physical Dimensions	Main Frame	Metallic suitable for one or two tubes
	Dimensions	700 × 1200 × 1700 mm (width, depth, height)
	Total Weight	400 kg
Power	Power	3 KW, 110/220 V, 3 Phase, 20/40 A
	Plasma Source RF	1KW/13.56 MHz
Applications	Micro Electronic, MEMs, NEMs, Nano-Structures (Carbon Nano-Tubes, etc)	



## Low pressure chemical vapor deposition (LPCVD) Sensiran SI-LP80

Sensiran Company is proud of introducing a sophisticated fabrication unit called as “low pressure chemical vapor deposition”. This unit which is called “LPCVD” for short, is one of the most important units in the fabrication of micro and nano-electronic devices and circuits. The formation of highly resistant silicon-nitride is feasible by using a proper mixture of silane ( $\text{SiH}_4$ ) and ammonia ( $\text{NH}_3$ ) in a low pressure quartz tube and at temperatures as high as 750 to 800 °C. Such a layer is used as the mask for micro and nano-machining purposes as well as a suitable barrier against thermal oxidation of silicon in a high temperature quartz furnace. In addition, the deposition of polysilicon films is feasible using this machine. For this material, one can use  $\text{SiH}_4$  and  $\text{H}_2$  as the carrier gas. The operation temperature is around 580 to 620 °C while the pressure is maintained at a few “torr” level.

Apart from polysilicon and silicon-nitride, LPCVD can be used for the deposition or growth of silicon nanowires where operation at lower temperatures around 400 °C is required. The use of ultra thin layers of “gold” as the catalyst for the decomposition of silane in a “Vapor-Liquid-Solid” reaction is a critical parameter in such a unit. The formation of silicon nanowires in a VLS process could be exclusively achieved in a machine of this nature and our LPCVD is one of the best and safest units for this purpose. Owing to the serious safety hazards of such a useful and exclusive unit, LPCVD machines are realized with great complexity and of course with higher costs. The SI-LP80 is a unit which has been designed with a novel “double-wall” stainless chamber to ensure about the safety of the system, once exposed to hazardous gases such as hydrogen and silane. A dual-pumping system allows achieving excellent conditions for the formation of suitable layers.



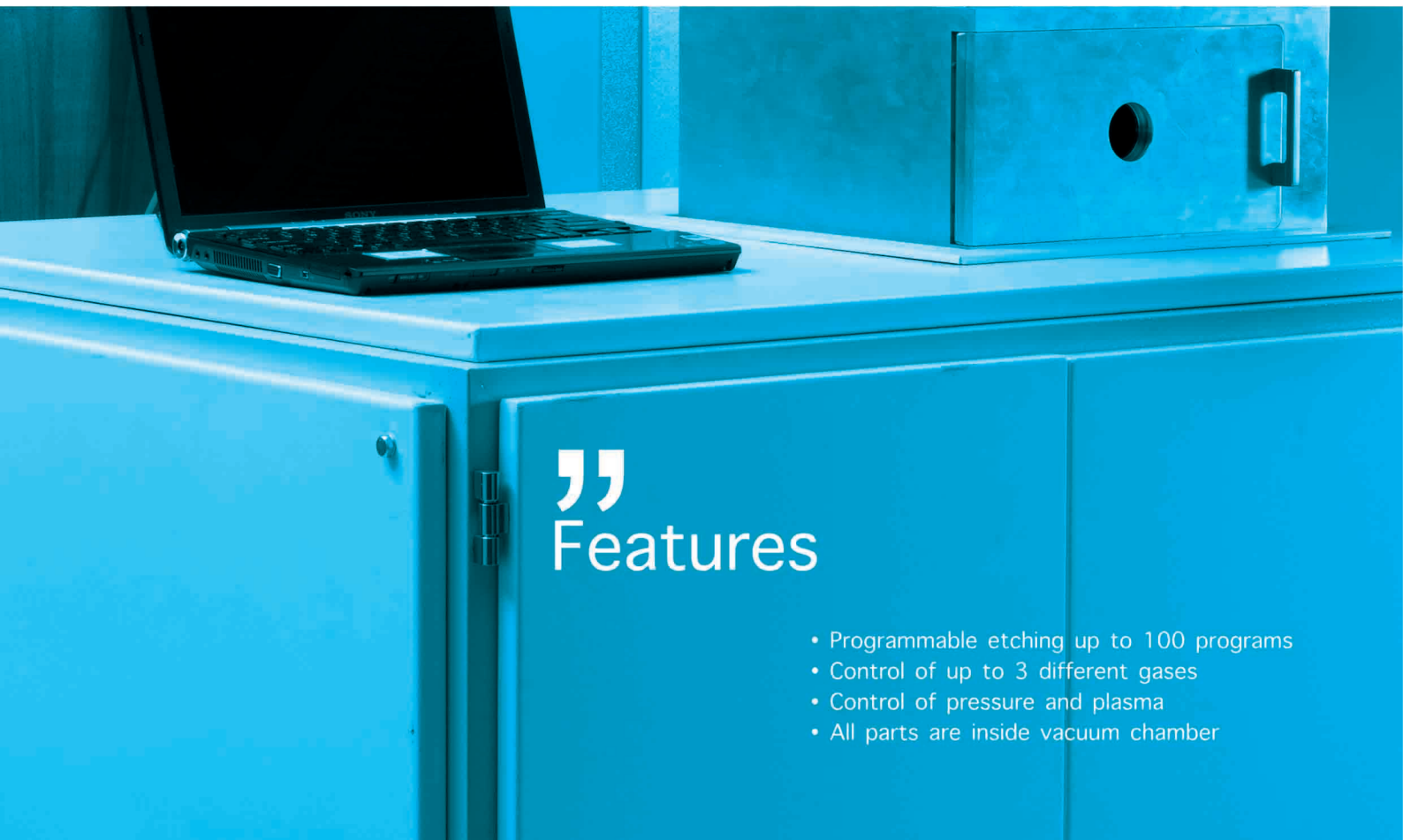
## ” Specifications

Model		LPCVD (SI-LP80)
Process chamber	Chamber Type & Size	Quartz tube reactor, 800mm in length
	Useful heat zone	200 mm in the middle of reactors
	Operating Temperature	500-850°C for different applications
Gas Module	Gas Distribution	Two mass flow controllers, SS lines Gas Ring, Main valve, Vacuum gage, Necessary connections, Up to 4 Gas Line
	Gases	Silane, Ammonia, Hydrogen(carrier gas) , Oxygen, Argon, etc
Pumping System	Vacuum Pumping Systems	rotary vane pump
	Base Pressure	Around 80 MiliTorr depended on processes
Control Module	Industrial PC/PLC	User Friendly windows7 Operator Interface- Temperature control unit
Physical Dimensions	Main Frame	Metallic suitable for one or two tubes
	Dimensions	700 × 1200 ×1700 mm (width, depth, height)
	Total Weight	300 kg
Power	Electrical	2 KW, 110/220 V, 3 Phase, 20/40 A
Applications	Micro-Nano Electronic, Nano-Structures (Nano-Wires, etc)	

## Deep Reactive Ion Etching (DRIE)

"SI-HV300" is a Deep Reactive Ion Etching (DRIE) machine, with capability of making vertical structures on silicon substrates. This machine uses a patented novel deep etching process which can make very fine vertical structures. The aspect ratio of structures can be as high as 50:1, while the dimensions can be as low as 100 nm. The DRIE process uses a mixture of 3 gases,  $H_2$ ,  $O_2$  and  $SF_6$  in a time multiplex technique with two successive steps: Etching and Passivation. The process is performing in room temperature. The whole process is controlled automatically using a computer. This machine can also be used for conventional RIE processes, such as plasma etching or ashing.

DRIE is a highly anisotropic etch process used to create deep penetration, steep-sided holes and trenches in wafers/substrates, typically with high aspect ratios.

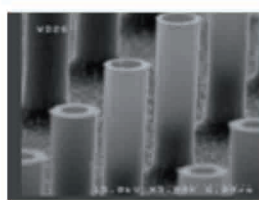
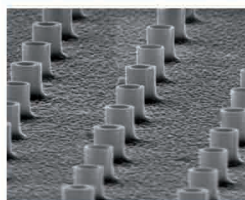
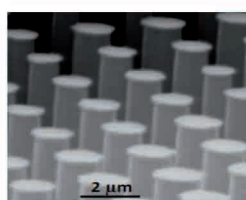
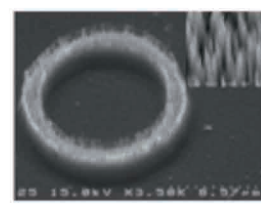
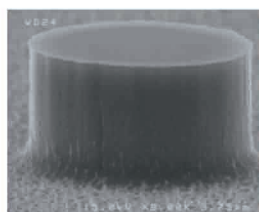
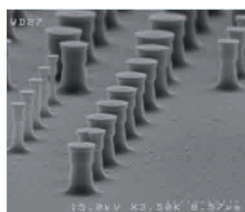


## ” Features

- Programmable etching up to 100 programs
- Control of up to 3 different gases
- Control of pressure and plasma
- All parts are inside vacuum chamber

# Specifications

Model	DRIE(SI-HV300)	
Process chamber	Process Range	Room Temperature
	Base Pressure	80 MiliTorr
	Chamber Type & Size	360x380x300 mm, 20 liter volume, Aluminum
Substrate Holder	Substrate Sizes	4 inch Wafer Size Capability
	Holder Material	Aluminum
Gas Module	Gas Distribution	Shower Head, MFC's, SS lines Gas Ring, Up to 6 Gas Line
Pumping System	Vacuum Pumping Systems	Two stage Rotary vane pump
	Mechanical Pump Capacity	10 mTorr
Control Module	Industrial PC/PLC	User Friendly windows7 Operator Interface
Connection systems	Water Connection	1/8 inch pipe
	Air Connection	6 mm pneumatic
	Exhaust	30 mm
Physical Dimensions	Main Frame	H1000 x D 900 x W1000 mm
	Total Weight	200 kg
	Outer Casing Material	Iron
Power	Power	5 KW- 3 Phase- 110/220 V- 20/40 A
	Plasma Source RF	300W/13.56 MHz
	RF Power	300 W
Plasma Etch Mode	RF Gas distribution plate for Isotropic etching	capable of switching from plasma to RIE mode during process
Process Gases	SF6 or CF4	Flow Rate : 0-200 sccm
	O2 , H2, N2	Flow Rate : 0-500 sccm
Applications	Electronic & Microelectromechanical systems (MEMS) Used to excavate trenches for high-density capacitors for DRAM Recently for creating through silicon via's (TSV)'s in advanced 3D wafer level packaging technology.	



FESEM Images of Micro and Nano Structures Etched by DRIE(SI-HV300)

