

# Microwave Plasma CVD Systems to Grow Carbon Nanotubes

As the field quickly moves from basic carbon nanotubes deposition to specialized multi-step post processing and characterization, there is a critical need for stable, reproducible and consistent deposition equipment that is flexible enough to incorporate any future developments in gas composition, substrate temperature and scaleup to commercial ventures.

Microwave plasma enhanced CVD is successfully utilized to deposit aligned carbon nanotubes (Figure 1). With over 1,000,000 hrs of operation logged at 200 sites, our microwave plasma technology is an attractive option for R&D scientists wishing to shorten their process development time and provide themselves with compatibility with other scientists and publications around the world.

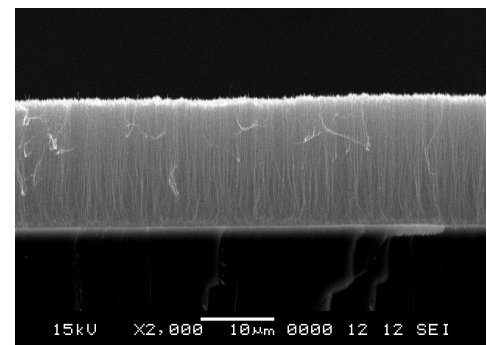


Figure 1 SEM micrograph showing aligned carbon nanotubes grown by microwave plasma assisted CVD (with permission L. C. Chen, National Taiwan University K. H. Chen, Academia Sinica)

## Microwave Plasma CVD Products



•AX5000



•AX5200



•AX6500

# Process Conditions

Process Variable	Typical	Current Product Capability
Deposition time	2-40 min	1 sec- >500hr
Substrate Bias	0V	-400V
Substrate temp.	550-700C	50C-1200C
Substrate area	5 cm sq	0.1-2000 cm sq
Catalysts	Pd, Ni, Fe	Any
Growth Rate	7 $\mu$ /min	unknown
Pressure	10-30 Torr	10-250 Torr
Gas composition	20% methane/hydrogen or acetylene/ammonia	Any gas composition excluding high concentrations of halogens
Plasma power	1KW	0.8-100KW

## Advantage of Our CVD Systems

- Uniform, highly aligned, large area growth of carbon nanotubes
- Process recipes (under development) provided with the system minimize development time
- Reliable, stable, reproducible, versatile operation
- Computer-controlled turnkey operation
- Available installation, on-site training, and after-sales support growth of different materials

## Raman Spectrometer

We also make high resolution compact Raman Spectrometer. Shown in Figure 2, Raman spectra of a CNT sample from our Raman spectrometer (STR 250).

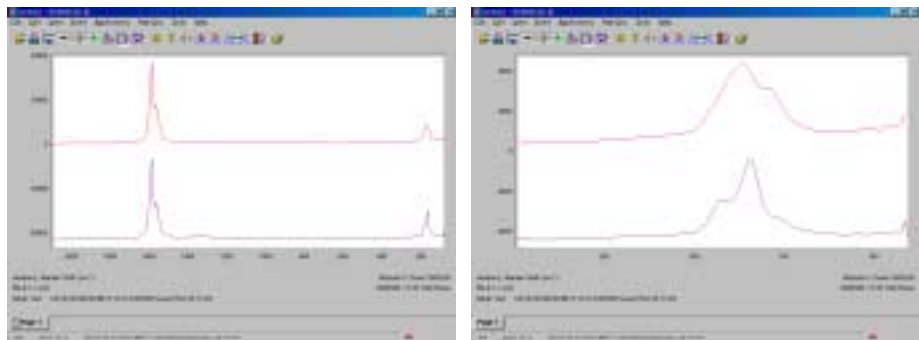


Figure 2 Raman spectra of a CNT sample using STR 250