Title : **CNTs Synthesis in Gas Flow with Size Selected Metal Particles under Low Pressure**

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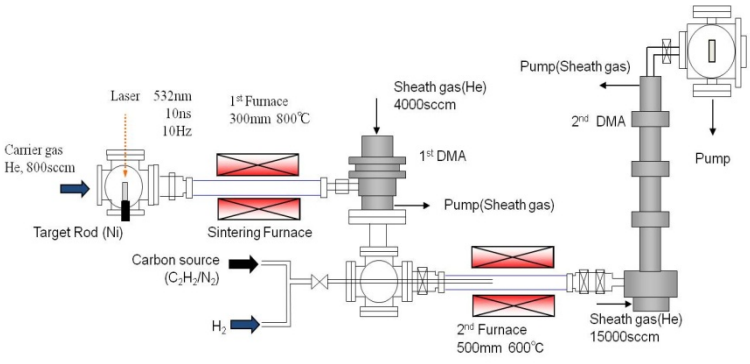
Abstract : Carbon nanotubes (CNTs) are a remarkable next-generation material; they are an active research subject in the nanotechnology field [1-2]. Understanding their growth mechanism and developing synthesis methods are crucial for controlling their geometrical structures. Since the discovery of CNTs, many synthesis techniques, such as the laser-oven technique [3], the arc-discharge technique [3], and various catalytic chemical vapor deposition (CCVD) techniques [4-5], have been developed. To apply CNTs in multiple areas, controlling its structures is one of the most important subjects. M. Zachariah and co-workers have reported multi wall nanotubes (MWNTs) synthesis from catalyst metal nanoparticles classified by size with differential mobility analyzer (DMA) under atmospheric pressure[6]. According to their reports, the distributions of metal nanoparticle size and MWNTs diameter are almost the same. In this study, CNTs are synthesized under low pressure by using chemical vapor deposition with catalyst metal nanoparticles classified by DMA. A low-pressure DMA system is employed for particle size classification because it enables the examination of the effects of synthesis pressure. It also makes it easy to prepare small nanoparticles because laser ablation under the low pressure can prevent nanoparticle cohesion and resultant enlargement. The diameter of each SWNT is about 1~4 nm, and size classification of nanoparticles at this level is considered necessary for SWNT synthesis.

Figure 1 shows a schematic drawing of the experimental apparatus. It consists of a nanosecond pulsed Nd:YAG laser (wavelength: 532 nm), three vacuum chambers, two electric furnaces (a sintering furnace and a reacting furnace) containing quartz tubes (sintering furnace: 20 mm in diameter, 50 cm in length; reacting furnace: 20 mm in diameter, 70 cm in length), a target rod (Ni) in the first vacuum chamber, and two DMAs. In the DMA, catalyst metal nanoparticles and CNTs are sorted according to the differences of electrical mobility.



First DMA is used to classify metal nanoparticles

by their diameter and second DMA is used to classify CNTs by their length. C_2H_2 is employed as a carbon source in this study. Along with the result of the experiment done under atmospheric pressure, MWNTs are produced under the low pressure, about 6kPa. The diameter of catalyst metal nanoparticles is almost equal to the diameter of CNTs. CNT size classification by length is also performed by second DMA.

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