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Damage free PECVD based on atmospheric pressure non-thermal plasma and application to high-purity vertically-aligned single-walled carbon nanotube synthesis TOMOHIRO NOZAKI, KUMA OHNISHI, KEN OKAZAKI, Tokyo Institute of Technology — We developed atmospheric pressure plasma enhanced chemical vapor deposition for vertically-aligned single-walled carbon nanotubes synthesis, in which both ion-damage and radical-damage are preferentially avoided in atmospheric pressure [1]. In this study, we performed on-line gas analysis using quadrupole mass spectrometer. A metallic capillary tube (O.D. 450 μm) was inserted into the cathodic sheath (thickness: 900 μm) and reacting gas was extracted for real-time gas analysis. The result revealed the main product was C_2H_6 , but CNTs were missing in the C_2H_6 thermal CVD. Ionic species such as CH_4^+ would have to be abundant reactive species in the plasma sheath. Those species are believed to once absorb on CNT surface and then migrated towards catalyst particles which are anchored on a substrate. We also studied the effect of total pressure. The D/G Raman peak ratios increased as total pressure decreased from 100 kPa to 20 kPa, although ion damage is neglected in this pressure range. Excessive supply of reactive species simultaneously formed amorphous carbon network that ultimately deteriorate CNT quality.

[1] T Nozaki et al. *Carbon*, 45, 364-374 (2007)

Tomohiro Nozaki
Tokyo Institute of Technology

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