

Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Source gas depletion in narrow metal tube during internal DLC coating with microwave-excited high-density near plasma¹ RYOSUKE MATSUI, HIROYUKI KOSAKA, NORITSUGU UMEHARA, Department of Mechanical Science and Engineering, Graduate School of Engineerig, Nagoya University — In internal DLC (Diamond-Like Carbon) coating to mm-sized narrow metal tubes by using MVP (Microwave-sheath Voltage combination Plasma) method, axially uniform distribution of film thickness can be obtained by repeating the depletion and homogenization of source gas in a coated tube during plasma-on time T_{on} and plasma-off time T_{off} of pulsed plasma generation, respectively. DLC was deposited to the inner surface of a stainless-steel tube 4.4 mm in inner diameter and 50 mm in length with small holes of $\Phi=0.4$ mm fabricated at every 10 mm, where the flow rates of Ar and methane were controlled to be 14 and 2 sccm, respectively, at a total gas pressure of 80 Pa. A pulsed negative voltage of -200 V was applied to the tube at a pulse frequency of 10 Hz and duty ratio of 3.2%, synchronizing a pulsed injection of 2.45-GHz microwaves at the same pulse frequency ($T_{on}=3.2$ ms and $T_{off}=96.8$ ms). The high-speed camera image showed that the emission (696, 706 nm) from Ar atom was approximately constant during plasma-on time. On the other hand, the emission (468-474 nm) from C_2 dimer was decreased until $T_{on}=1.5$ ms, and then converged in a constant value; this is ascribed to the consumption of CH_4 gas which is considered to be a main source of C_2 dimer formation.

¹This work was partly supported by a Grant-in-Aid for Young Scientists (B), No. 23760695, from the Japan Society for the Promotion for Science.

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Date submitted: 15 Jun 2012

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