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Effect of atomic composition on hardness of Si-containing a-C:H films deposited by ultra-high-speed PECVD at over 100 micron/h[1]
HIROYUKI KOUSAKA, YASUYUKI TAKAOKA, NORITSUGU UMEHARA, Nagoya University — Plasma CVD is often employed for depositing DLC (Diamond-Like Carbon) due to its excellent capability for coating 3-dimensional shapes; however, its coating speed is typically not so high, ~ 1 μm/h due to the use of low-density DC or RF plasmas. We have proposed an ultra-high-speed DLC coating at over 100 μm/h where much higher-density plasma is sustained by microwave propagation along plasma-sheath interface. In this work, Si-containing a-C:H films (one type of DLC) were deposited on steel substrates by different 2 methods: DC plasma and microwave-excited high-density near plasma, or our newly proposed method, where the gas composition of Ar, CH_4, C_2H_2, and TMS, and the duty ratio of microwave and substrate bias were changed at a fixed substrate bias of -500 V. For example, under the same condition except microwave injection, the deposition rate and hardness of the DLC deposited by DC plasma were 2.5 μm/h and 11.8 GPa, respectively; while the deposition rate and hardness of the DLC deposited by microwave-excited high-density near plasma were 156 μm/h and 20.8 GPa, respectively. The atomic composition of the films was evaluated by XPS for C, O, and Si, and RBS-ERDA for H/C ratio.

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