18p-A8-16

Behaviors of optical and corrosion properties of *a*-C:H films at different thicknesses

°S. Tunmee, X.L. Zhou, Y. Nakaya, S. Arakawa, I. Toda, K. Komatsu, S. Ohshio, H. Saitoh

Nagaoka Univ. Tech., E-mail: s137011@stn.nagaokaut.ac.jp

[Background] Recently, the *a*-C:H film was improved on properties such as optical, corrosion, mechanical and structure for high performance on applications in the industry. Especially, the both optical (refractive index (*n*) and extinction coefficient (*k*)) and corrosion properties were interested in research which are also controlled by sp^2 structure in the matrix. Besides, these properties are a function with a thickness of film. Therefore, the aim of this work was studied the behaviors of optical and corrosion properties of *a*-C:H films at different thickness.

[Experimental] The *a*-C:H film was deposited on *p*-type Si (100) substrates at different thicknesses by radio-frequency plasma-enhanced chemical-vapor-deposition technique (rf-PECVD) with 0.5 kV of bias voltage and 13.56 kHz of rf power, using benzene (C_6H_6) and hydrogen gas (H_2) as precursors. Raman spectroscopy are performed to characterize the chemical bonding information of *a*-C:H films. The optical properties of all films were investigated by spectroscopy ellipsometry (SE) method, which is non-destructive method. The corrosion behaviors of all samples were analyzed by electrochemical technique (potentiodynamic polarization) in air-saturated 3.5 wt.% NaCl solution for pH 2 at room temperature. In addition, the field-emission scanning electron microscopy (FE-SEM) has been used to study the surface of uncorroded and corroded regions.

[Results & Discussion] The Raman spectra displayed an asymmetric diamond-like peaks in the range of 1000-2000 cm^{-1}, representative of *a*-C:H films; two broad peaks were detected, a D-band centered around 1374-1391 cm^{-1} and G-band centered around 1571-1577 cm^{-1}. The decreasing of I_D/I_G ratio that it might indicated to the small sp^2 clusters in matrix. In addition, the *n* values had tendency increased whereas the behavior of *k* values had changed with thickness arise. The corrosion behavior of *a*-C:H films showed the corrosion potential (E_{corr}) and corrosion current density (I_{corr}) values as in the range of 201-289 mV and 1.9×10^{-4} to 9.96×10^{-5} μA/cm^2, respectively, which is high society amorphous carbon materials, depended on sp^2 cluster into film. The corrosion rate of *a*-C:H films were less than uncoated sample. Here we presented to the corrosion types of *a*-C:H films as localized corrosion (pitting) which is one of the most corrosion aggressive as shown in Fig. 1. However, our *a*-C:H films indicated to high performance corrosion resistance in air-saturated 3.5 wt.% NaCl solution for pH 2; it also had protective efficiency as 98%-reach. Therefore, the optical and corrosion properties had changed that cause from different thickness of *a*-C:H films.

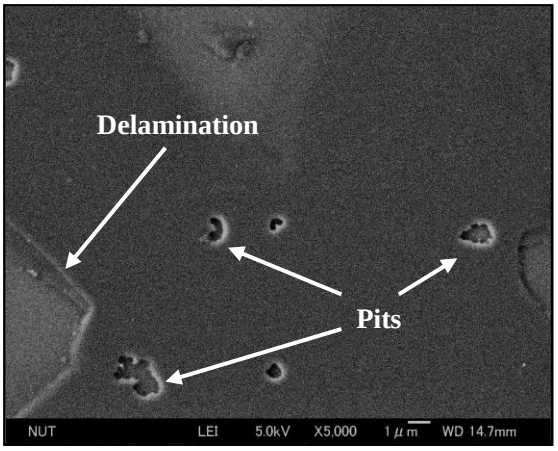

Fig. 1 FE-SEM image of localized corrosion on the surface of *a*-C:H films in 3.5 wt.% NaCl solution.