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Dependence of Secondary Electron Emission Coefficient γ on Thin Film Thickness of a-Si:H

Sung-Chae Yang, Byung-Yoon Chu and Ho-Jin Kim
Division of Electronics & Information, Chonbuk National University

Plasma enhanced chemical vapor deposition (PECVD) method has been widely used to prepare a functional thin film such as hydrogenated amorphous silicon (a-Si:H) and hydrogenated amorphous carbon (a-C:H). Recently, various experimental and numerical studies on variation of discharge characteristics have focused on variation of a secondary electron emission coefficient (γ coefficient)⁽¹⁻⁴⁾.

However, the temporal variation of discharge characteristics normally occurs in the early stages of the deposition process of thin films such as a-Si:H and a-C:H. In this study, attention will be paid mainly to the effect of the temporal variation for the γ coefficient. Therefore, in order to clarify the mechanism of the temporal variation of discharge characteristics, we estimate the γ coefficient of a-Si:H thin films deposited at the early deposition time by breakdown characteristics (Paschen's Law), in a dc silane plasma

However, it is noted that the variation of the γ coefficient should be measured as a function of only deposition times but also thin film thickness. Regrettably, a substantial thin film thickness in the early deposition time, particularly take an interest, cannot be measured exactly because the film thickness of this region is not more than \sim nm. Therefore, we estimate the temporal variation of SiH* optical emission (414.2 nm), which is proportional to a-Si:H deposition rate⁽⁵⁾. Using these data, the thickness of a-Si:H thin films for all over the deposition times can be estimated. From the above investigation, the variation of γ coefficient is obtained as a function of thin film thickness.

[References]

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