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Enhancement of the Virtual Metrology Performance for Plasma−assisted Processes by Using Plasma Information (PI) Parameters

**Seolhye Park[1], Juyoung Lee[1], Sangmin Jeong[2], Yunchang Jang[3],
Sangwon Ryu[3], Hyun-Joon Roh[3], and Gon-Ho Kim[3]**

[1]Samsung Display, [2]Samsung Electronics, [3]Seoul National University

Virtual metrology (VM) model based on plasma information (PI) parameter for C4F8 plasma-assisted oxide etching processes is developed to predict and monitor the process results such as an etching rate with improved performance. To apply fault detection and classification (FDC) or advanced process control (APC) models on to the real mass production lines efficiently, high performance VM model is certainly required and principal component regression (PCR) is preferred technique for VM modeling despite this method requires many number of data set to obtain statistically guaranteed accuracy. In this study, as an effective method to include the 'good information' representing parameter into the VM model, PI parameters are introduced and applied for the etch rate prediction. By the adoption of PI parameters of b-, q-factors and surface passivation parameters as PCs into the PCR based VM model, information about the reactions in the plasma volume, surface, and sheath regions can be efficiently included into the VM model; thus, the performance of VM is secured even for insufficient data set provided cases. For mass production data of 350 wafers, developed PI based VM (PI-VM) model was satisfied required prediction accuracy of industry in C4F8 plasma-assisted oxide etching process.

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