In-Situ Monitoring Method of Plasma Process Equipment Condition: Deposition andCleaning

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A keyto success to have a consistent plasma processing is the maintaining aconsistent process chamber condition over a production period. Plasma enhancedchemical vapor deposition (PECVD) process forms a thin film on the chamber wallas well as wafer-in-process, and the deposited film on the chamber sidewall andshower head must be periodically removed to maintain the required waferquality. In this research, we investigated amorphous carbon layer deposition(ACL) process using cyclopropane with inert gases. In-situ process monitoringsensors were employed to investigate the plasma chamber conditions of both thedeposition step using direct plasma and the cleaning step using remote plasma.The employed in-situ sensors are VI-prove, optical emission spectroscopy (OES),self plasma-optical emission spectroscopy (SP-OES), optical plasma monitoringsensor (OPMS). During the deposition, we have monitored plasma condition andstability associated with RF power condition via VI-prove, OES and OPMS. In thechamber cleaning step using remote plasma system do not allow plasma monitoringthrough sidewall because of the plasma generation is not taken place in thechamber, so we employed SP-OES to monitor by-product gas chemistry during thechamber cleaning process step. We have successfully confirmed that each in-situplasma process monitoring sensors have the limitation to use from theirdetection mechanism, and the use of their proper combination can elevate theresult of the process monitoring.

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