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Important aspects of reactive High Impulse Power Magnetron Sputtering

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High Power Impulse Magnetron Sputtering (HIPIMS) is a technologically important Physical Vapour Deposition process that is able to provide a highly ionised flux of sputtered species. It is thought to be particularly important for applications where there is a need to coat 3D features (e.g. vias and trenches in semiconductor industry). HIPIMS may have other added benefits, as compared to DC or medium frequency AC/pulse-DC magnetron sputtering, that are related to improved coating structure-property relationship control through self-species ion assistance. Enhanced structure and properties of thin film materials produced in reactive sputtering are also highly desirable.
Significant progress related to providing control means for reactive HIPIMS processes and ensuring stability has been made recently. This paper reports on the recently developed Plasma Monitoring (PM) based reactive HIPIMS control/monitoring method and its performance as compared to that of conventional PM, Penning-PM and I-sensor based methods. PM based process control technology is shown to provide precise control and stable operation of reactive HIPIMS discharges anywhere within the hysteresis loop. It also appears to be superior when compared to oxygen partial pressure control based techniques. Since PM provides information on the sputtered flux and target state, important knowledge on the features of reactive HIPIMS processes can be obtained using this technique. Examples of such process features in titanium – oxygen system are presented in this paper.

Keywords
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