A New Approach to Electrostatic Measurements for Semiconductor Wafers

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Abstract:

Characterizing electrostatic charges within semiconductor equipment has always been extremely challenging. Most methods require measurements at near-contact proximity to the product, which is effectively impossible for contained and often hazardous processes. A new measurement technique in the form of an integral Faraday instrument can perform in-situ readings to evaluate substrate charge generated by process recipes, sources of in-tool contamination and product related electrostatic discharge.

This Faraday FOUP device is capable of measuring charge on 300mm wafers while directly integrated through the tool's front-end wafer handler, avoiding the associated measurement noise and historical problems of external measurements. In addition, large serial wafer runs can be performed to identify charge clustering and other previously uncharacterized phenomena.

This paper will review how the Faraday FOUP device has already yielded valuable information on wafer type and recipe correlations, resulting in increased productivity by reducing wafer damage and contamination. As an example, the stochastic nature of tribocharging effects related to substrate handling often produces highly skewed charge measurement distributions related to extreme maxima. Substrates within a given batch can exhibit charging shifts related to hidden variables in the process and differentials in triboelectric effects. Some discussion of how statistical prediction methods, including Pareto, Weibull and interference models can lend themselves to determining critical thresholds and the effectiveness of remediation efforts. This paper will also discuss how this type of study has contributed to understanding rare event probabilities which can entail significant costs for tool vendors and process owners.