Run-to-Run Control Utilizing Virtual Metrology for Real-Time Compensation to Enhance Yield in Semiconductor Manufacturing

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Abstract

Real-time quality monitoring is required to ensure process stability and enhance wafer yield. Especially for the process condition between preventative maintenance that may lead to the inconsistency of process output that cause defect wafer. This study proposes run-to-run (R2R) control utilizing virtual metrology (VM) for real-time compensation to enhance yield in semiconductor manufacturing. R2R control utilizing VM model was proposed to adjust equipment recipe settings for feedforward compensation of preventative maintenance. An empirical study in chemical vapor deposition (CVD) was conducted in a Taiwan semiconductor company for validation. The thickness difference caused by preventative maintenance was reduced from 571Å to 60Å in training data and 564Å to 110Å in testing data. The results showed practical viability of the proposed approach and an intelligent system embedded with the proposed approach has been implemented.