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The CD Uniformity Control in PSPI Merge Process by Optimization of Various Process Variable Factors in DRAM Manufacturing

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Polyimide (PI) has been used for the passivation layer against the soft error from alpha particles as well as the physical damage from package processes in various memory chips. Small hole and straight line pattern in PI passivation layer should be existed to connect outer input and output electrical signal through wire bonding with these memory chips, and to enable the fuse repairing process. Traditionally, these patterns was realized by the wet etch process with TMAH (tetra-methyl ammonium hydroxide) solution after photoresist (PR) patterning steps. PSPI (Photosensitive Polyimide) has been developed to eliminate PR patterning process in this PI passivation layer since PSPI acts as the patternable material as well as the passivation layer. Nonetheless, PSPI shows inferior resolution to PR since there is inherent restriction to increase resolution in PSPI and the thickness of the usual PSPI layer is much higher than that of PR.

The Critical Dimension (CD) uniformity is very important in the process of photosensitive polyimide (PSPI) because the pattern size has been drastically decreased and the margin for this patterning process is very small as compared with the process of non-photosensitive polyimide(PI). CD variation in a wafer could directly affect the yield trend and process defects in DRAM manufacturing. Thus, the CD uniformity control is the major factor to eliminate hidden costs in device manufacturing. In this study, various factors that could affect CD variation in a wafer will be investigated and the optimization of these process variables will be done to realize the CD uniformity in Silicone process.

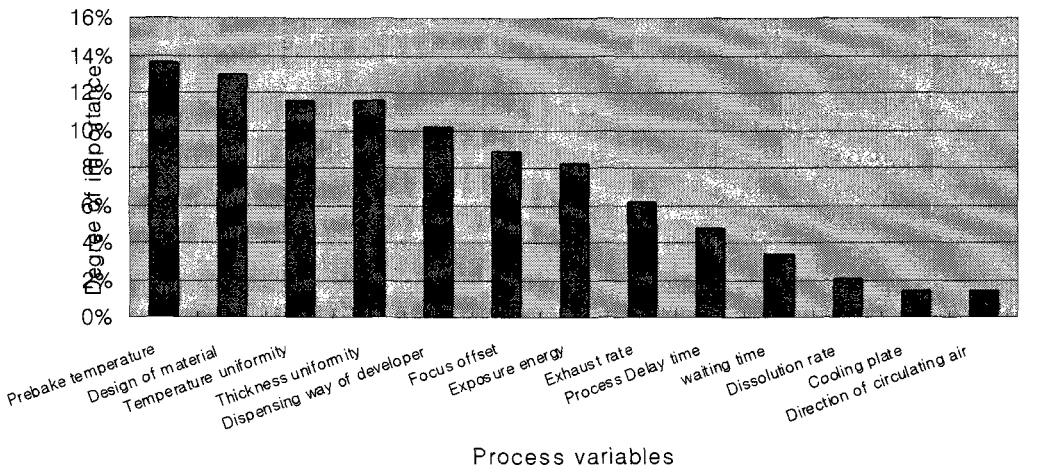

Figure 1. Factors affecting CD uniformity in a wafer. This pareto charts was drawn after reviewing fishbone diagram and FDM analysis for various process variables that can be controlled in usual manufacturing in a fab.