

# **Dry Etch Technologies for Next Generation Small Pitch Patterning at EUV Lithography Era**

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As EUV lithography era opens the requirement for dry etching technology to overcome the limitation on etch selectivity, etch rate loading at different pattern aspect ratio(A/R), defect(including process particles) control and TTTM(Tool To Tool Matching) of production chambers. To overcome those limitations the etch technology has evolved so far to control independently ion energy and radical density more, which are electrical separation – time separation – reaction separation – special separation. I introduce the new technologies, ultra high gas flow, ultra low pressure, ultra low temperature and ultra high ion energy which are included into the reaction separation. But that trend makes the etch process more complicated and longer and so the total number of control parameters to maintain etch chambers and process outputs is increasing to a few thousands. Recently M/L(Machine Learning) was introduced to analyze big data from mass production lines, because engineer based analysis cannot be done with so big data anymore. Finally the direction etch technology is introduced to overcome the next limitation on pattern LER(Line Edge Roughness), small bridge defect and Tip-to-Tip between patterns.