

Directions for sub 100nm photomask cleaning (\leq 90nm Nodes)

- ❑ Continue and increase current programs to:
 - ❖ Understand limits of current photomask clean technology
 - ❖ Engage suppliers to develop alternative photomask clean technologies
- ❑ Add efforts to:
 - ❖ Fund fundamental research on clean, including new novel technologies
 - ❖ Understand particle adhesion (modeling)

Progress in this area MUST be accelerated!

NEU Study on Particle Removal

- NorthEastern University Ahmed Busnaina and Jingoo Park (Hanyang University)

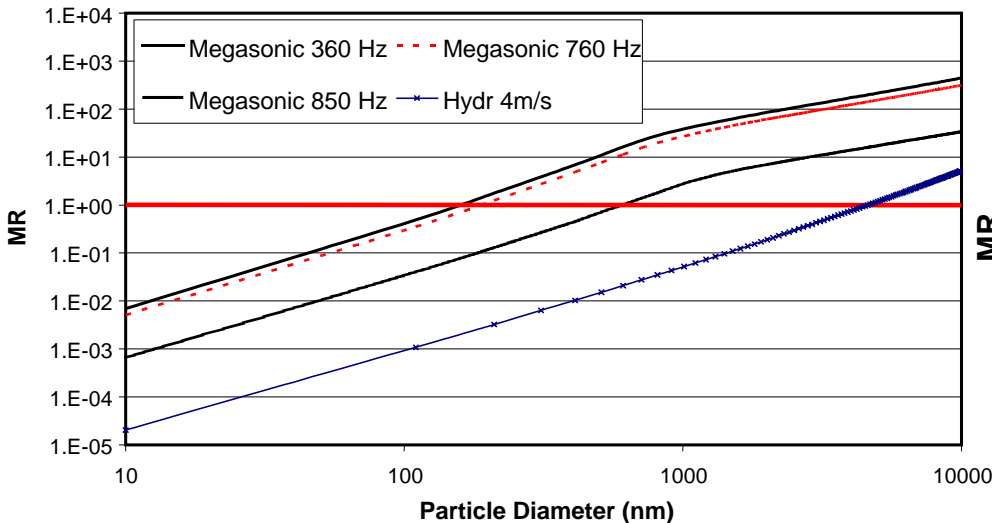
Removal of < 100nm particles remains a challenge

Rolling removal mechanism

$$RM = \frac{M_R}{M_A} = \frac{\text{Removal moment}}{\text{Adhesion resisting moment}}$$

$$RM = \frac{F_d(1.399R - \delta) + F_{dl} \cdot a}{F_a \cdot a}$$

Removal Moment Ratio vs. Particle Diameter for Si3N4 on SiO2 in water



Moment Ratio MR vs. Particle Diameter for PSL on SiO2

