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Behavior of particles in plasma etching apparatus

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The behavior of particles in a plasma etching apparatus was investigated with an in-situ particle monitor. The properties of particles can be classified into three types according to the particle velocity. Slow-velocity particles (much less than 1 m/s) are trapped by a plasma-sheath boundary and rarely fall on the wafer during plasma discharge. These particles should be removed from the region above the wafer before turning off the plasma. Medium-velocity particles (a few meters per second) travel above the wafer surface due to a balance between ion drag and electrostatic forces during plasma discharge. The number of particles that attach to the wafer can be reduced by supplying wafer bias power. Fast-velocity particles (a few dozen meters per second or more) are generated by the reflection of particles in a turbo molecular pump (TMP), and these may damage the fine photoresist pattern on the wafer by colliding with it. It is therefore important to decelerate the fast-velocity particles by using gas viscous force.