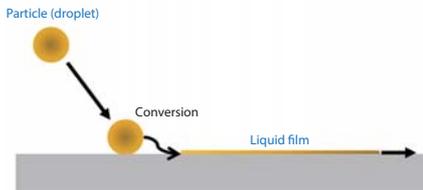# Analyses of Spray/Painting Nozzle and Single-Wafer Cleaner

Lquefaction of particles is analyzed using scSTREAM and SC/Tetra

Analysis of Spray/Painting Nozzle (SC/Tetra)

Liquid Film Model

Method to analyze liquid film moving along wall by considering material property (density and viscosity) and thickness of film formed by liquefaction of particles on wall. Has a small calculation load because it does not consider surface tension or contact angle.
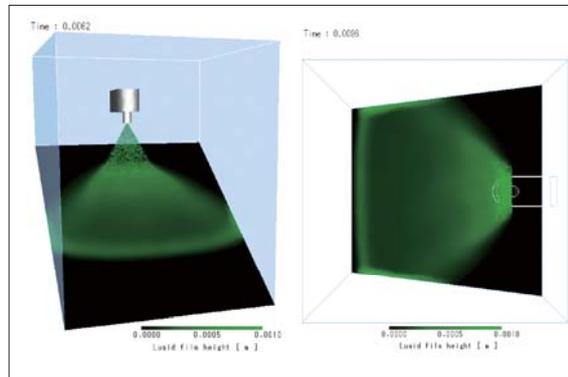
Analysis Results

Figure 1: Analysis result (left: view from the side of the nozzle, right: view from above the nozzle)

Plate	50 mm× 40 mm Placed at an angle
Spray particle	Diameter 100 [μm] Painted by spraying from the nozzle and liquefying on the plate
Thickness of painted film	In the order of 1 [mm] Particles are sprayed in a flat shape with long axis 30°, short axis 10°

➡ **Virtually uniform painting of the liquid can be confirmed**

Analysis of Semiconductor Single-Wafer Cleaner (scSTREAM)

Method to Use Free Surface Flow Analysis in Combination
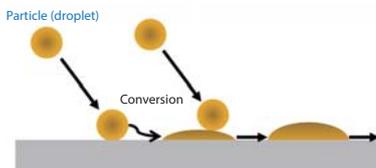
Particles are converted to liquid when they adhere to wall or liquid surface. The particles converted to liquid are vanished and no longer tracked. Since the method considers surface tension and contact angle, it can analyze breakups and cohesions of liquid; however, calculation load is large compared to the liquid film model.
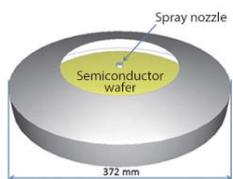
Analysis Results

Figure 2: Single-wafer cleaner

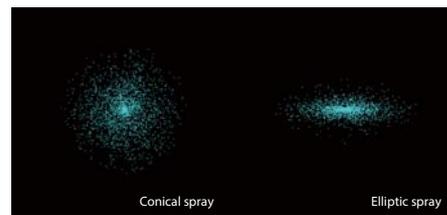|	
Spray nozzle	Particle diameter 50 [μm] (1-fluid nozzle)
Spray flow rate	0.50 [kg/s] 30 L/min
Spray velocity	15 m/s
Material	Pure water (cleaning water)
Contact angle	50°

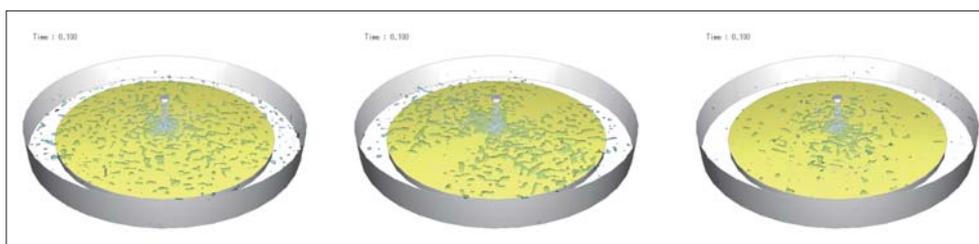Figure 3: Conical spray with spray angle 30° (left), 5° (right)

Figure 4: Cleaning water after 100 seconds. Conical spray (left), elliptical-cone spray (middle), elliptical-cone spray 2,500 rpm (right)

➡ **For elliptical-cone spray, higher rotation speed of the wafer for better cleaning efficiency spreads cleaning water in the circumferential direction.**

Notes

Using scSTREAM and SC/Tetra, liquefaction of particles are simulated with Particle Tracking Method.