

Introduction

One of the most demanding liquid flow applications for the semiconductor industry is chemical mechanical polishing (CMP) slurry. CMP slurry is typically composed of 5-10% silica solids suspended by means of chemical dispersants, surfactants, pH extremes and physical agitation.

Slurry Particle Agglomeration

Under adverse conditions, the suspended solids in CMP slurries can agglomerate into larger solids, risking wafer defects due to scratches on the wafer surface. The slurry particle size for optimum planarization is typically 0.1 – 0.5 μm. When slurry particles inadvertently agglomerate to larger size, scratches can occur.

CMP solids are more likely to agglomerate into large particles during system upsets, exposure to moving parts, operation under non-steady state conditions, exposure to dead ends where solids can settle, system start up and pilot plant processing.

Under steady state process conditions, the NT® Electronic Flowmeter or NT® Integrated Flow Controller orifice will not clog when used with high purity chemicals and slurries common to the semiconductor industry. NT® Electronic Flowmeters use differential pressure technology

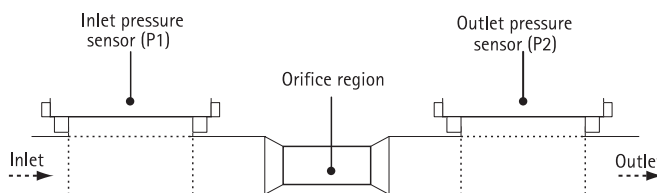


Figure 1. Differential Pressure Flow Measurement Technology.

to measure flow. Simply, this involves measuring the pressure before and after a flow-through designed orifice.

$$\text{Flow} \propto k \sqrt{(P1-P2)}$$

The typical NT® Electronic Flowmeter orifice diameter is 1-2 mm for flow ranges 100-500 ml/min. Under steady state conditions, slurry particles are typically 1 μm or smaller, approximately 1/1000th the size of the flowmeter orifice. Flowmeter clogging under steady state process conditions will not typically occur.

Slurry Filtration

As noted, flowmeter clogging under steady state conditions will not occur due to the 1000:1 ratio between the minimum orifice diameter and the maximum slurry particle size during steady state processing.

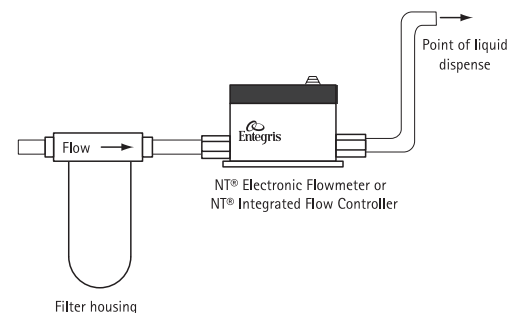


Figure 2. Flowmeter placement between filter housing and point of liquid dispense.

CMP slurry systems that operate under non-steady state conditions can inadvertently cause slurry agglomeration. Non-steady state process conditions include initial system start-up, upsets in system chemistry, non-ideal operating conditions, experimental pilot operation, etc.

Therefore, any particles in the liquid stream that are large enough to clog a 1 mm (1000 μm) diameter orifice will also be large enough to scratch the wafer.

Many Fabs employ point of use filters to remove unwanted large particles from the fluid stream prior to planarization. Since it is important to remove unwanted large particles from both the flowmeter and the wafer, the filter should be placed in the liquid stream prior to the flowmeter.

Entegris designs and manufactures measurement instruments for the high purity and corrosive chemical environments of the semiconductor industry. Our products measure flow, pressure and level for the various acids, caustics, solvents and slurries used in the industry.

For More Information

For more information on flowmeters and flow controllers or our complete line of fluoropolymer fluid handling solutions, contact your local Entegris distributor or Entegris, Inc.

To review our complete line of sensing and control product solutions visit Entegris' Web site at www.entegrisfluidhandling.com or contact Entegris Customer Service.

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