

Application Process

Microelectromechanical systems (MEMS) are used commercially as sensors, controllers or actuators as they are very cost effective. Logitech has designed a CMP system where single wafers or ICs with MEMS devices in place can be polished to planarize the surface topography to within angstrom levels.

Logitech has developed a technology package which fully meets the requirements of this demanding application.

Expected results for a 4" wafer on a Logitech System are:

- **Flatness:** $\pm 2\mu\text{m}$ mounted or $\pm 3\mu\text{m}$ free
- **Surface Finish:** Scratch free
- **Surface Roughness:** $<3\text{nm}$. (Measured using a Dektak 150 contact profilometer)
- **Thickness Control:** $\pm 2\mu\text{m}$
- **Parallelism:** $\pm 2\mu\text{m}$

(process results will vary slightly according to the quality of sample being used)

Complete Systems for the preparation of

Chemical Polishing

Technology Transfer

Training and process technology trials at Logitech cover equipment and wafer handling, cleaning, bonding, gauging and process adjustments, with which the operator needs to be familiar. Logitech are dedicated to complete success and through training at our purpose built laboratories or at client premises, the team ensures that personal training is provided at a level relevant to the clients process requirements.

Years of experience has identified that instruction manuals alone do not provide operators with the levels of knowledge and success that are achievable through personal training and practical experience. Logitech are so committed to this programme of technology transfer that it provides a full three day training course, with all material processing systems sold. Courses cover all aspects of system operation, maintenance and customer focussed process trials. This unique approach ensures successful installation, optimum use and maintenance of Logitech systems.

Client Support

Support is provided directly by Logitech and via an extensive global network of, Logitech trained, dealers. This enables us to provide a consistently high level of localised support and services from our technical base in Scotland.

A 12 month warranty is provided for all Logitech machines purchased. The client support policy at Logitech aims to resolve any client issues, be it mechanical, electrical or technological, in a fast and effective manner. The "no quibble" policy for replacement of faulty components ensures that any response to client difficulty is immediate.



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Precision equipment for the production of damage free polished surfaces.



Precision Materials Processing

Introduction

Modern electronic devices require stringent control over wafer geometry in terms of; surface flatness, specimen parallelism and thickness. They also demand samples with a high quality surface finish, as preparation for subsequent processes. To achieve this many organisations use chemical polishing as a finishing process on a wide range of materials, as this provides excellent surface polish with minimal surface and sub-surface damage to the crystal lattice structure.

Typical instances where chemical polishing is required for the final etch polishing of:

- Thin and ultra thin wafers of semiconductor materials such as Gallium Arsenide and other III-V and II-VI compounds with or without microcircuitry or other device architecture.
- Materials such as Cadmium Telluride and Mercury Cadmium Telluride for use in infra-red detectors and focal plane arrays.
- Material such as Indium Phosphide and Cadmium Sulphide for use in opto-electronic applications.
- Materials such as Gallium Arsenide and Cadmium Telluride as essential preparation for epitaxial growth where an improperly polished surface can seriously affect the orientation of the grown crystals.

All Logitech systems are built with flexibility in mind and easily integrate into your fabrication programme, offering a quick and reliable route to success for the chemical polishing of samples. The benefits this provides are:

- **Flexibility:** low initial investment during the project development stage with the ability to easily increase capacity.
- **Productivity:** Logitech systems increase sample yield due to fast processing times and easy process conversion.
- **Quality:** Individual machines can be dedicated to specific stages of the process, ensuring quality and yield are optimised.

Application Analysis

What is Chemical Polishing?

Chemical polishing is the controlled removal of material from samples using chemical etch combined with a polishing action to leave a high grade surface.

The key advantage of chemical polishing over mechanical polishing is the reduction of sub-surface damage to the crystal structure.

In mechanical polishing fine scratches appear in the material during the initial coarse polishing. These scratches are also associated with dislocations and deformations of the material.

During polishing with finer polishing agents, the surface quality will improve until no surface defects are visible - even under a microscope. However, this appearance can be very misleading as filled-in scratches, microcracks, pits and dislocations may be hidden by the surface flow of the material. Often referred to as the "amorphous" or "Beilby" layer. The area of microcracks and dislocations hidden by this layer is lapping damage that has not been removed by polishing. It is under this layer you will find the undisturbed material, with a crystallographic perfection representative of the interior of the specimen.

Products & Services

Chemical Polishing

In chemical polishing material is removed from the sample surface by a dissolving process that does not damage the sub-surface structure. Therefore preventing any associated microcracks and dislocations forming. The surface produced is perfect for applications where lack of polishing damage is of primary concern.

The treatment of samples by chemical polishing is dependent on many variables, such as temperature and the composition of the etchant mix. It is also important to use a variety of different etchants in the process, depending on the sample material and the results required.

One of the standard Logitech chemical polishing process routes uses a Bromine Methanol mixture to achieve the damage free surface desired. A lower concentration of bromine in the methanol produces better results whilst reducing the "orange peel" effect.

Logitech recognises the hazards associated with the use of Bromine Methanol, as a polishing agent, and has designed its products for safety and effective control. We recommend careful handling of the mixture at all times and the addition of a neutraliser to the waste sump, to break down the bromine after polishing.

Depending on the sample material, the final surface quality can be improved by applying weight to the specimen during processing. A Logitech holder assembly with corrosion resistant weights provides a variable loading facility.

Since the chemicals used for this treatment are highly aggressive, it is imperative that a corrosion resistant machine is used with an operator safe process. Logitech CP3000 and CP4000 Chemical Polishing units are designed to fulfil these criteria, whilst delivering high quality samples.

CP3000 Chemical Polishing Unit

This robust, corrosion resistant system provides a highly safe and convenient means of polishing a wide range of materials. The automatic cut off mechanism maintains operator safety at all times, whilst the compact size minimises fume cabinet space.



Logitech CP3000 System

CP4000 Chemical Polishing Unit

This fully integrated system guarantees maximum resistance to aggressive chemical polishing agents. With its own fume extraction enclosure, greater volume and sample size capability than the CP3000, the CP4000 is ideal as a self-contained unit for higher volume chemical polishing work.

Chemical Process Equipment

The Logitech range of CP systems have been designed to meet both research and production needs in chemical polishing.

The CP3000 and CP4000 Chemical Polishing machines provide:

- Excellent surface finish on a wide range of materials.
- Minimal sub-surface damage to the crystal lattice structure.
- Large production throughput capacities where necessary, depending on the process and the material.
- Versatility and adaptability for the R&D environment.



Logitech CP4000 System

A summary of features relevant to materials processing laboratories include:

- Corrosion resistant construction from polypropylene, PVDF and epoxy painted polyetherane.
- Adaptable deck arrangements to accommodate varying sample sizes and geometries.
- Careful attention to safety aspects and operator convenience.
- Suitability for most types of aggressive etching agents (e.g. Bromine Methanol).

A complete system for thinning materials can be achieved by adding a Logitech PM5 or LP50 machine and a Logitech precision jig. This will enable you to prepare samples using an abrasive lapping process prior to being polished on a CP3000 or CP4000, to remove any remaining traces of surface or sub-surface damage.

A comprehensive range of accessories, components and consumables are available to support these systems, enabling optimum results and longevity of the machines. For information on these products please see www.logitech.uk.com

Chemical Polishing System Specifications												
	Construction materials	Maximum capacity	Integral fume extract enclosure	Available drive arrangements	Plate size	Plate rotation speed	Adaptable deck arrangement	Easy access for maintenance	Safety cut-outs	Process timer facility	Power supplies	Net weight
CP3000	Epoxy painted, polyetherane PVDF, corrosion resistant materials	3 off 3 1/4" (8.3cm) wafers to 1 off 8" (20.3cm) wafer	No	Gear drive unit	Up to 14" (35.6cm) dia.	0-70rpm	Yes	Yes	Yes	Yes	220v/50HZ 110v/60Hz 110V/50Hz	42kg
CP4000	Polypropylene, PVDF, corrosion resistant materials	9 off 3" (7.6cm) wafers to 3 off 8" (20.3cm) wafers	Yes	Gear drive unit	Up to 18" (45.7cm) dia.	0-70rpm	Yes	Yes	Yes	Yes	220v/50HZ 110v/60Hz 110V/50Hz	145kg