Application Process

Lithium Niobate (LiNb03) is frequently used for optical waveguides, optical modulators, mobile phones, piezoelectrics and linear/ non-linear applications.

Logitech has developed a technology package which fully meets the requirements of these demanding applications.

Expected results from a Logitech System for a 3" diameter sample is:

- **Flatness**: <4µm
- **Surface Finish:** <4µm
- **Surface Roughness:** <1nm
- **Thickness Control:** +/-2µm
- **Parallelism:** +/-2µm

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

Technology Transfer

Training and process technology trials at Logitech cover equipment and sample 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 purchased. 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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LOGITECH
Materials Technologists & Engineers

Complete Systems for the preparation of

Opto-electronic Materials

An adaptable range of systems for defect free face & edge polishing

Precision Materials Processing

Introduction

Established in 1965, Logitech has many years experience in the design and manufacture of high precision equipment. The team are highly knowledgeable in processing Opto-electronic materials, to precise tolerances with scratch free surfaces.

Our systems are typically used are in the processing of:

- Silicon,
- Lithium Niobate,
- Lithium Tantalate,
- Bismuth Silicon Oxide
- Barium Titanate
- Other opto-electronic materials

All Logitech systems are built with flexibility in mind and easily integrate into your fabrication programme, offering a quick and reliable route to success in the final preparation of your opto-electronic material samples. The benefits this provides are:

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

Application Analysis

Our technical team work, in confidence, with customers to identify the most relevant system for optimum results on their particular material processing problems. Initial discussions provide a detailed understanding of production quantity, surface finish and geometric tolerance requirements.

Logitech systems are used in the fabrication process of devices such as optical phase modulators for:

- Slicing the wafer from the crystal boule with an annular diamond saw
- Smooth lapping and polishing of wafer faces to defect-free quality (Sub nm Ra.)
- Cutting of substrates from the polished wafer
- Bonding of diffused plates to form a stack and polishing with minimal edge roll off and chipping

Whilst this brochure details a number of typical applications, we are able to provide system packages tailored to your precise needs. This may include the design and manufacture of custom holding fixtures or modifying integral parts of the system.

Typical Process Route for Opto-electronic Substrates

Wafer Slicing

Boules of up to 78mm in diameter can be sliced to a precise thickness using an annular saw. A Logitech automatic saw such as the APD1 or APD2 enables you to cut samples without supervision. These precision, high speed annular saws, with single or multiple cut options are ideal for cutting fine wafers of opto-electronic materials with minimum kerf loss and surface damage.

Wafer Mounting

The wafer is bonded to a glass support plate with wax or high shear strength temporary bonding medium . A gentle load is applied by a bonding press, to give the required uniformity of bond thickness.

APD1 Annular & Peripheral Saw

Dicing the Wafer into Substrates

The support plate is held on the rotary table assembly of the APD1/APD2 and the wafer cut into strips and then into substrates of the required length. The APD1 saw is particularly suited to slicing and dicing wafers, as it easily moves from annular to peripheral sawing configurations. An optional rotary table with indexing facility is available for both the APD1 and APD2 peripheral saws, allowing cuts to be made at a known angle to each other.

Smooth Lapping of the Wafer

The diced wafer substrates are mounted on to a Wafer Mounting Plate on a PP5 Precision Lapping & Polishing Jig. This is then lapped and polished using either a single station PM5 machine or a three station LP50 machine with appropriate plates, abrasives and fluids. This advanced lapping and polishing machine with easy to use controls, is efficient and reliable for both main face and edge lapping and polishing operations. Versions of the PM5 and LP50 are available with automatic plate flatness control, providing greater levels of repeatability and improved sample quality.

Stack Temporary Bonding of Substrates between End Glass Wasters

The sawn substrates are removed from the support plate, cleaned and "stacked" by bonding them together with a minimal thickness layer of hard wax. The individual planks are bonded together (stacked) using an alignment jig in conjunction with a bonding jig, for accuracy. The stack is completed by end glass wasters which are prepared in a similar way to the substrates, the glass wasters protect the edges of the material being processed. Using the Alignment Jig and the Bonding Press, eight to ten planks can be bonded into a stack, with controllable bond thickness.

Logitech Alignment Jig

Polishing the Stack Ends

After cleaning excess wax from the bonded stack, it is mounted in a Stack Clamping Holding Fixture on a customised PP5 Precision Polishing Jig. This precision holding fixture offers a high degree of control over parallelism and is ideal both for lapping and polishing opto-electronic materials when used with appropriate accessories. For additional accuracy the jig and fixture can be used in conjunction with an LG2 autocollimator, resulting in a stack parallelism in the range of seconds of arc.

Dismantling the Stack

This is a critical stage which must be carried out very carefully to ensure there is no chipping of the fine square edges of the planks.

Inspecting the End Result

The substrates are now ready for inspection by microscope before passing on to the next stage of processing.

Further details on these products can be found at **www.logitech.uk.com.**

PM5 precision lapping & polishing system

Quantity

The quantity of finished samples produced per week depends on factors such as system capabilities and process route used. The example below is based on the processing of opto-electronic substrates using either one or two, single workstation, PM5 lapping and polishing machines:

No of PM5 Machines	Output Substrates per Week	
1	22 using off-saw wafers	66 using pre-polished wafers
2	60 using off-saw wafers	140 using pre-polished wafers

Opto-electronic System Range				
	Positional Accuracy	Speed	Capability (Max)	
Wafer Slicing & Dicing				
	Positional Accuracy	Speed	Dicing	Slicing
APD1	y-axis 7.5µm/x-axis 5µm	100 - 5000 rpm	102mm	55mm
APD2	y-axis 7.5µm/x-axis 5µm	100 - 3000 rpm	152mm	78mm
AWS1	-	0 - 400 rpm	-	102mm
Wafer Mounting & Bonding - Bonding Jigs				
	Number of Positions	Wafer Dia Process (Max)		
BJ12	12	83mm, 105mm or 112mm		
BJ9	6	112mm		
BJ6	6	83mm, 105mm or 112mm		
BJ2	2	83mm, 105mm or 112mm		
Wafer Lapping Systems				
	No Workstations	Removal rates	Flatness	Wafer Dia Process (Max)
PM5	1	2µm/min	<2µm: 2" & 4" <4 to 6: 6" & 8"	Up to 100mm (4")
LP50	3	2µm/min	<2µm: 2" & 4" <4 to 6: 6" & 8"	150mm (6") or smaller multiples
Wafer Polishing Systems				
	No Workstations	Av. Surface Roughness	Wafer Dia Process (Max)	
PM5	1	<3nm	Up to 100mm (4")	
LP50	3	<3nm	150mm (6") or smaller multiples	
Precision Polishing Jigs				
	Specimen Parallelism	Angular Adjustment Range	Outside Diameter	
PP5	<2" of arc	+/- 3.0°	83mm	
PP6	<2" of arc	+/- 3.0°	112mm	
Measurement & Inspection				
CG-10	Linear measuring range: 10mm	Accuracy over range: 1µm	Up to 300mm (12")	
NCG-2	Measurement range: ±1.25mm	Accuracy: ±1µm	Up tp 150mm (6")	
LI10 Fizeau Interferometer	Surface Roughness: <20nm	Fringe Spacing: 0.335µm	100mm (4")	
GI20	Surface roughness: 1nm to 300nm Ra	Fringe spacing: 2µm	150mm (6")	
LG2 Autocollimator	Typical setting accuracy: <2 arc secs	Adjustment Range: ±3 mins of arc	Aperture: 25mm (1")	