

Application Process

Gallium Nitride (GaN) is widely used in semiconductor and opto-electronic materials and components. It can be used to emit bright light emitting diodes (LEDs) and laser diodes, as well as being a key material for high power, high frequency transistors capable of working at high temperatures.

Logitech has designed and developed a range of lapping and polishing systems capable of creating flat, thin and uniform samples with hard materials like GaN.

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

- **Flatness:** $\pm 1\mu\text{m}$ per 25mm
- **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 processing of

Hard Materials

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 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.



Logitech Limited

Head Office

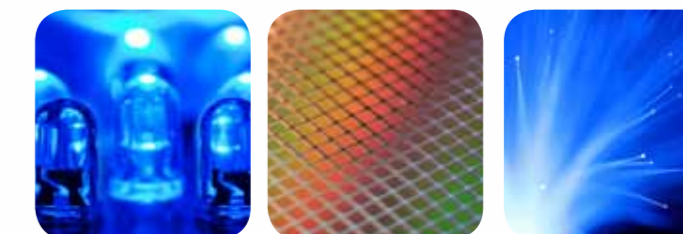
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Precision equipment for the production of flat, thin and uniform material samples.



Precision Materials Processing

Introduction

Processing of hard materials is a common requirement due to the increasing development and use of LED's. Typical materials are sapphire, gallium nitride (GaN), aluminium nitride (AlN) and silicon carbide (SiC). Creating a flat, thin and uniform sample is a challenge with such materials. Using over 45 years of experience Logitech has developed a range of systems dedicated to this field, delivering optimum results with minimum processing times.

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 processing of hard materials. 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.

Comprehensive technology transfer and customer support is provided by Logitech with every full system purchased.

Application Analysis

Our technical team at Logitech work directly with customers to develop a customised system, that will achieve optimum results from their particular processing applications. Initial discussions provide a detailed understanding of production quantity, materials to be processed, sample thickness, surface finish and geometric tolerance requirements. All of which are discussed under an pre-defined confidentiality agreement.

Typical options in this area are;

- Wafer-support disc bonding of low, medium or high precision
- Jig controlled mechanical lapping and polishing using single or multi-workstation machines
- Gauging and inspection facilities to suit the required end result

Logitech's unique consultative approach ensures that customers achieve the best possible results from the advanced Logitech machine system and application processes.

Products

Processing

Typically a two stage process is required, consisting of lapping and polishing. The lapping process allows removal of bulk material in a fast and controlled manner, the polishing process removes the damage caused by the lapping and creates a high quality surface. The Logitech DL Lapping systems and DP Polishing systems deliver optimum results across both research and development and production level applications.

Lapping

The DL series of equipment can be customised for hard material processing, the DL lapping machines are available as a single workstation (DL1) or four workstation (DL4) unit. Functionality is the same on both machines, with the DL4 catering for higher throughput requirements.

The DL machines build on the know-how of previous Logitech systems, using precision jigs to hold the samples and ensure high levels of control and accuracy.

Where the DL differs from other systems is in the overall size of the machine, which can hold multiple samples, and the use of a driven jig rather than a free rotating jig. This delivers higher levels of control and increased removal rates, which are key when working with hard materials.

Individual samples are held in place by a template with individual vacuum points, that can be customised to suit the required sample size, for easy loading and unloading of samples. The system is easily controlled by the embedded PC with touch screen, providing quick access to system controls, stored recipes and for monitoring, recording and storing process parameters.

The **PP9 precision jig** (as shown in the adjacent picture) allows precise control of the sample orientation and fine adjustment of the load applied during processing. The easy to read LCD digital gauge provides accurate information to within 1µm.

The PP9 jig has a load range from 0.2 to 9.5kg.



DP4 System

Polishing

Polishing of hard materials using conventional methods is a time consuming exercise. The DP machines have been designed to greatly reduce process time through the use of driven head technology. High levels of force (up to 50kg) can be applied to each polishing head, with the rotational speed of processing and polishing plate controlled through the embedded PC touch screen.

Samples are held in place on the polishing heads using templates. Sample carriers are easily interchangeable, allowing for different sample sizes. Control of the DP system is very similar to the DL, making it easy for the operator to move between the two systems. The DP machines are also available as a single workstation (DP1) or four workstation (DP4) unit.



DL4 System



Application Processes

Typical requirements and results for processing 2", 3" and 4" samples:

	Sapphire	Silicon Carbide (SiC)	Gallium Nitride (GaN)
Diameter	50mm	50mm	50mm
Target Thickness	<100µm	100µm	<150µm
Surface Roughness*	<2nm	<5nm	<2nm
Flatness	+/- 2µm	+/- 2µm	+/- 2µm
Parallelism	+/- 2µm	+/- 2µm	+/- 2µm
TTV	+/- 2µm	+/- 2µm	+/- 2µm
Lapping Removal Rates	4-7µm/minute	3-6µm/minute	5-10µm/minute
Polishing Rates	8-12µm/hour	3-5µm/hour	2µm/hour Gallium Nitride side 20µm/hour Nitrogen side

* Surface roughness is measured on a Dektak 150 contact profilometer.

Hard Material System Range

Lapping Systems					
	No Workstations	Platen Size	Carrier Head Size	Sample Size (Diameter mm/inch)	Quantity
DL1	1	560mm/22"	210mm	50mm/2" 75mm/3" 100mm/4" 150mm/6" 200mm/8"	10** (7) 4 2 1 1
DL4	4	700mm/27.5"	210mm	50mm/2" 75mm/3" 100mm/4" 150mm/6" 200mm/8"	40** (28) 16 8 4 4
Polishing Systems					
	No Workstations	Platen Size	Carrier Head Size	Sample Size (Diameter mm/inch)	Quantity
DP1	1	560mm/22"	300mm	50mm/2" 75mm/3" 100mm/4" 150mm/6" 200mm/8"	20 9 5 2** (1) 1
DP4	4	700mm/27.5"	260mm	50mm/2" 75mm/3" 100mm/4" 150mm/6" 200mm/8"	16 7 4 4 4

** These are the maximum number of samples per system, for best results we recommend allowing more space between samples to maximise slurry flow and ensure even material removal. Numbers in brackets are recommended sample quantities.

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