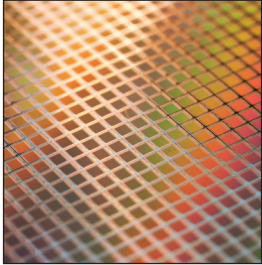


# Application Note

## Silicon on Silicon



### 1. Introduction

Many research and production facilities increasingly seek successful methods of thinning down the top wafer of a two wafer fusion bonded assembly to achieve a final thickness as low as 2 microns.

A typical application for such a process includes the use of the ultra-thin wafer as

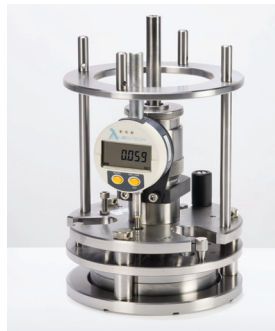
a "flexing" mirror to redirect laser light for high definition screens. Logitech's proven high performance system packages deliver high quality results and substantial time saving efficiencies.

### 2. Application requirements

In order to thin the upper wafer to within the sub 5 micron level, two silicon wafers need to be bonded together with a fused silicon oxide coating between the wafers. This silicon oxide fusion bonding process, which is normally undertaken by the customer, has a coating typically of a thickness of several microns.

As these thicknesses tend to be at the limit of flatness of commercially available silicon, it is important to characterise the wafer flatness and thickness uniformity of individual wafers prior to bonding. It may also be necessary to lap and polish the wafers to improve upon the initial specification.

Once bonded to a glass substrate (this allows the wafers to be processed without fear of damage), the wafers are mounted by vacuum chucking on to a PP5GT or PP6GT Precision Lapping and Polishing Jig. The jig(s) are loaded onto a Logitech precision lapping and polishing machine for lapping on a cast iron plate. A dial gauge indicator on the jig shows the material removal during the process.



Logitech PP6 Polishing Jig

This enables the user to automatically process their wafers to a pre-determined, programmed thickness without having to supervise the process and provides a continuous display of material removed to within one micron.

After lapping, the substrates are cleaned and placed once more onto the appropriate Precision Polishing Jig and polished using a softer polishing plate at high speed.

### 3. System specification

Dependent upon the level of production required by the operator, Logitech have several systems based upon the LP50 and PM5 precision lapping and

- 1 Introduction
- 2 Application requirements
- 3 System specification
- 4 Processing
- 5 Results

polishing machines. These units are both capable of producing excellent, repeatable results, the only difference between the two being that the LP50 can accommodate three jigs while the PM5 is a single workstation unit capable of accommodating one jig.

Available in each of these machines, Logitech's unique patented automatic lapping plate flatness control system helps increase the level of precision achieved with each of these processing systems. By removing the requirement to spend valuable time on process plate maintenance, the automatic lapping plate flatness control system ensures that the plate maintains its preset shape throughout the lapping / polishing process.



Logitech PM5 Lapping & Polishing System

### 4. Processing

#### A. Sample mounting

The double wafer assembly is initially bonded to a parallel, lapped glass support disc. To achieve a flat and parallel bond between the glass support disc and the lower silicon wafer the WSB2, Wafer Substrate Bonding Unit is used. The WSB2 can be programmed to bond samples over a wide range of temperatures and applied loads. Available as either a single or three headed unit, the WSB2 can bond up to three wafers at a time and incorporates both vacuum and pressure bonding facilities.

#### B. Lapping

This process involves significantly reducing the upper wafer thickness using a Logitech lapping plate and abrasive on either a PM5 or LP50 unit.

#### C. Polishing

The upper wafer is polished to its final thickness using a colloidal silica polishing solution on either a synthetic or cloth polishing pad.

#### D. Results

Following the straightforward process outlined above will produce excellent results, including achieving an upper wafer thickness in the range of 2 to 4 microns in a relatively short period of time.

## 5. Test & Measurement

### A. Thickness measurement

Product target thickness can be verified by using the CG10 Contact Gauge. This unit will provide accurate thickness measurements to within 0.001mm with excellent repeatability and linearity.



### B. Flatness measurement

During the lapping and polishing process the GI20 Flatness Measurement System can be used to provide a quick and accurate indicator of the level of flatness being produced during the process. Suitable for use with both lapped (non-reflective) and polished wafers the GI20 is a grazing incidence interferometer.



## 6. Operator Training

The purchase of each machine system from Logitech entitles the purchaser to receive free operator training at our purpose built laboratory facilities in the United Kingdom.



System training at Logitech's purpose built laboratories

Each training and process technology trial at Logitech covers equipment and sample handling, cleaning, bonding, gauging and process adjustments with which the operator must become fully familiar in order to achieve optimal processing results.

Over the years, experience has shown that instruction manuals alone do not provide the operator with the necessary subtle details.

Only an intensive programme of personal training and experience provides a solid basis for the continued efficient and successful use of Logitech systems.

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