Advances in InP processing using Logitech PM6

Lapping & CMP Polishing

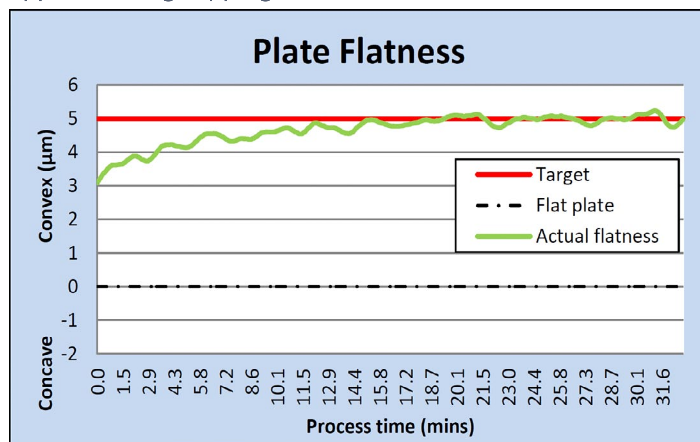
This application note illustrates the versatility and control benefits using the Logitech PM6 auto-lap and polishing precision system for processing II-VI semiconductor materials. The techniques and controls outlined below allow the customer to use auto-plate flatness control, via bluetooth technology, during Lapping, and end point thickness control for both Lapping and CMP processing, utilising time weighted averaging. The data below was produced from processing 76.2mm (3”) InP.

General process sample preparation before wafer backside thinning

Typically the InP wafer (50.8mm [2”] or 76.2mm [3”] diameter) is temporarily mounted (with wax or thermal release tape) using the Logitech wafer bonding substrate unit (WBSU) to a 83mm diameter parallel glass substrate to be vacuum held on to the Logitech PP5 type precision jig on the PM6 precision machine.

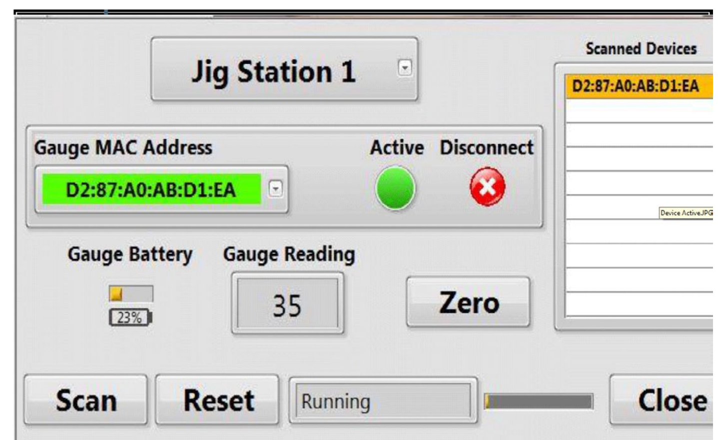
Automatic plate flatness connectivity and control

The 30cm diameter glass plate is conditioned and shaped according to the customer requirements (typically flat or slightly convex plate) in order to achieve desired lapped sample surface shape. The insitu control of the plate flatness shape is governed by the test block / load and the auto-plate flatness monitor unit via Bluetooth connectivity.
The machine controller monitors the data and moves the driven roller arm to the desired position to correct or maintain the plate flatness target (where adjustments are made to +/- 0.5um to target). In this case a 5um convex plate was applied during Lapping.



Lapping (Process thickness target control)

The process jig gauge is paired with the machine controller, so that the gauge and battery life can be displayed on the machine settings page. During the lapping process, the process jig was loaded with sample & substrate at the desired load (typically around 20-50g/cm2 for a 76.2mm diameter [3” InP]). The process parameters were setup with plate speed (10-30rpm) and abrasive flowrate (5-15ml/min) for the calcined aluminium oxide abrasive solution. At the process start the process jig gauge is zero’d so that the insitu target end thickness can be programmed to stop the process (eg in manual mode) and used as an event insitu in recipe mode. For Lapping of InP, due to the dense plate surfaces and softer abrasive solutions being used then the amount of process noise is low so the Time Weighted Average (TWA) function is set with a low number (eg. TWA = 1 = raw data detection). The surface roughness after the final lapping step is around 130 - 150nm, thickness around 110-120µm and TTV of 5-6µm due to the plate shape required.
Generally should the abrasive being used be of large and harder particles then the TWA would be set to a higher number (eg. TWA = 20-40 for #240 grit Boron Carbide).



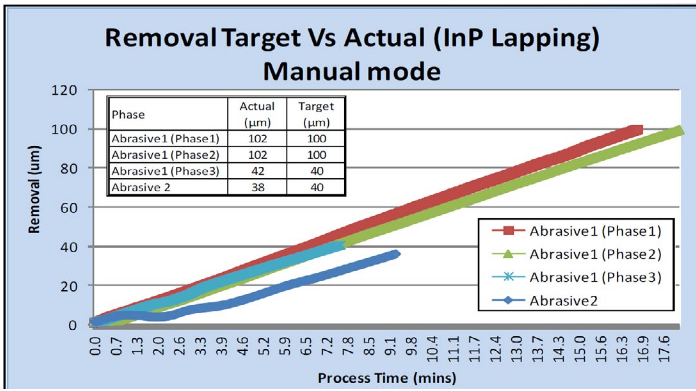


Fig 1 - Manual mode (single step) removal target

The sample removal control is completed via individual cycles in manual mode (Fig 1) or it is completed in continuous step in recipe mode (Fig 2). The progress of the removal can be viewed real time on the machine via the data graphics as well as downloaded via USB stick after the process is completed for review and charting. Below shows the data after exporting to USB stick. It is seen that in manual mode the delta between the programmed target and the actual measured target is within +/-2um. The benefit from the recipe mode is that you have the ability to change process parameters based on events (eg changing from a large particulate abrasive to a smaller particulate abrasive) without stopping the process. Using recipe mode also allows the user to improve the end point accuracy further by programming a final process step to reduce the plate speed for the remaining few microns (typically +/-1um accuracy). Recipe mode can also be paused and continued if some action requires to be taken based on observation.

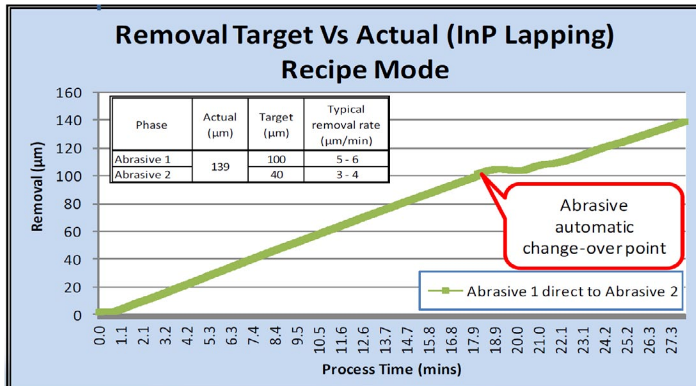


Figure 2 - Recipe mode (multi-step) removal target

After the lapping targets have been reached then the sample is removed and cleaned as is the machine and process jig with mild detergent and insitu water/air gun. The lapping plate and accessories are removed and are replaced with the required InP polishing pad and accessories ready for processing to commence. Process change-over typically takes only 4-5 minutes.

CMP Polishing (Process thickness target control)

For polishing then the sample/substrate is loaded again to the process jig where a heavier load (eg. 50-70g/cm2 for 76.2mm [3" InP]) and plate speed is applied (50 – 80 rpm) with a proprietary Logitech polishing solution. Due to the soft compressible nature of the pad, the polishing solution and the motion of the process jig then there is much more process environment noise, the number of jig averages requires to be increased to provide increased accuracy to stop the process at the desire target thickness. Fig 3 shows the process control when "Jig Averages = 1" and Fig 4 shows the performance when "Jig Averages = 30". When the Jig Averages is increased then the change of stopping the process at the correct time is significantly improved, where the final thickness is 100µm, with Roughness of 1-2nm (Ra) and TTV of <3µm.

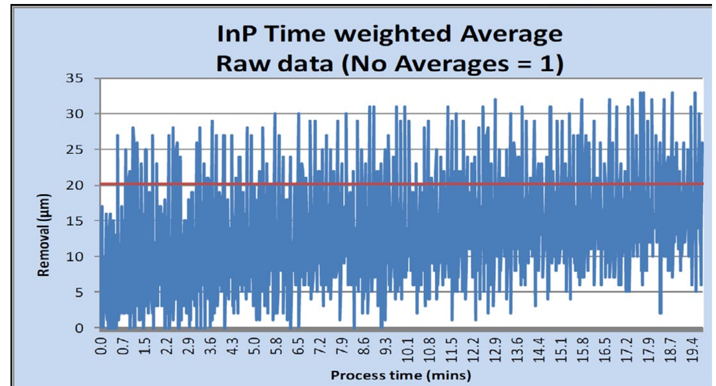


Figure 3 - Jig Averages = 1 (Removal range ~ 25um) No accuracy

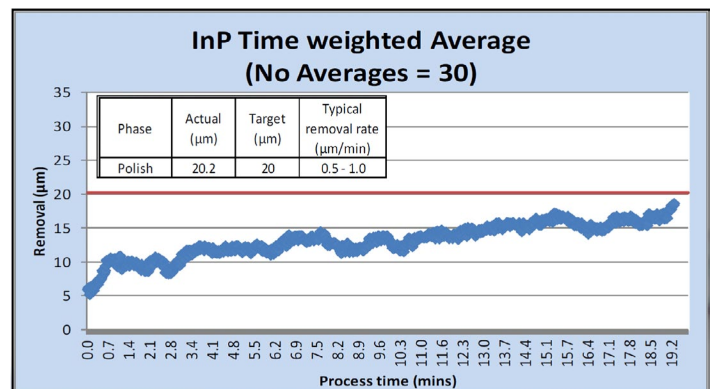


Figure 4 - Jig Averages = 1 (Removal range ~ 2um) Accuracy <0.5um

Logitech Limited
Erskine Ferry Road, Old Kilpatrick
Glasgow, G60 5EU, Scotland, U.K.

Tel: +44(0) 1389 875444
e-mail: enquiries@logitech.uk.com
www.logitech.uk.com