

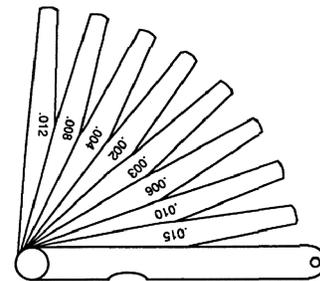
Corning Tech Notes

Grazing Incidence Interferometry VS Contact Gage

In the world of flatness measurements, the Tropel® FlatMaster® system, manufactured by Corning Tropel, is an industry leader in accuracy, throughput, and ease of operation. FlatMaster systems are commonly used for measuring the flatness of semiconductor wafers, photomasks, hard drive disks and a host of industrial components.

There is a major worldwide communications industry where 500 million new devices are brought to market every year; on average, 1.3 million new devices are built *every day*. Each device has at least one small form-factor display cover glass; some have two. Every day, more than 1.3 million display cover glasses have to pass a flatness inspection.

Current solution: A long granite table, with several dozen inspectors, each armed with a set of feeler gages. Each inspector slides the gages between the table and the display cover glass to determine flatness. Care must be taken; the parts are flexible and edges are chamfered.



Common Feeler Gage

Proposed solution: Corning Tropel has visited manufacturing facilities to demonstrate the superiority of the Tropel FlatMaster system.

Three observations from these demonstrations:

1. Using feeler gages on thin, flexible materials creates an unacceptably high false failure rate.
2. The flatness requirement is outside the typical range of the FlatMaster system, normally 100 μm dynamic range; the system was reconfigured for a 300 μm flatness range.
3. Although this isn't a typical FlatMaster precision application, the high volume easily justifies the system cost.



Tropel® FlatMaster®

1) Using feeler gages on thin, flexible materials creates an unacceptably high false failure rate.

A sample of 200 pieces of cover glass was selected. 100 of these samples failed flatness testing based on the feeler gages, and the other 100 samples passed. With a flatness tolerance in excess of one hundred microns, the test parts are displayed in 5 percent increments of tolerance. The red ones were failed by feeler gage; the green ones were passed. Measured with the FlatMaster, NONE were out of tolerance.

Manufacturers typically produce between 10,000 and 50,000 units per day. After several process steps, approximately 30% of all finished parts were failed by the feeler gages at final inspection.

The FlatMaster system was used to double-check the parts that had initially failed inspection and were slated to be scrapped. Only 5% of all the cover glasses failed by the feeler gages were found to actually be out of tolerance. That is a 95% false failure rate.

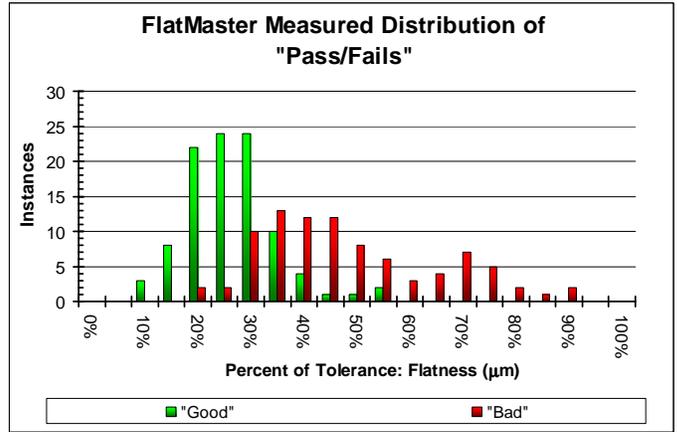
That means for every TWENTY "failed" units, only ONE should have been rejected!

2) The flatness requirement is outside the typical range of the FlatMaster system, normally 100 µm dynamic range; the system was reconfigured for a 300 µm flatness range.

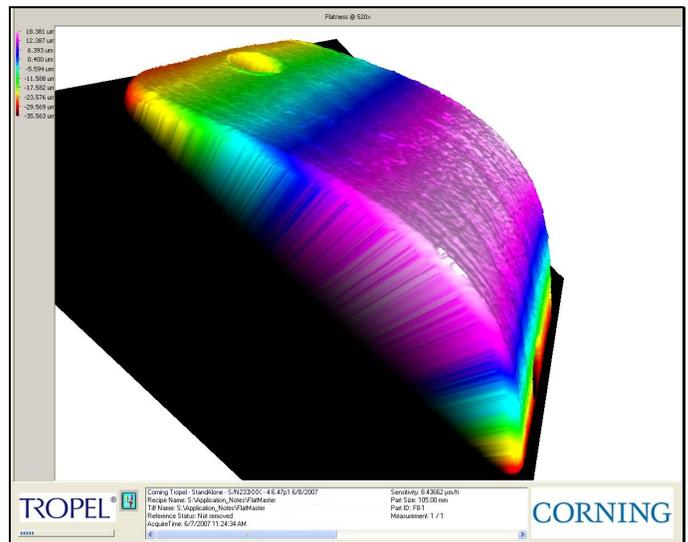
The FlatMaster system is normally used to measure parts with a flatness tolerance in the tens of microns or less. The tolerance for display cover glasses is in the hundreds of microns. The question is not whether the Flatmaster is capable of fine enough measurement. Instead, can the FlatMaster system measure a broad enough range to deliver a result to the customer?

The answer is yes.

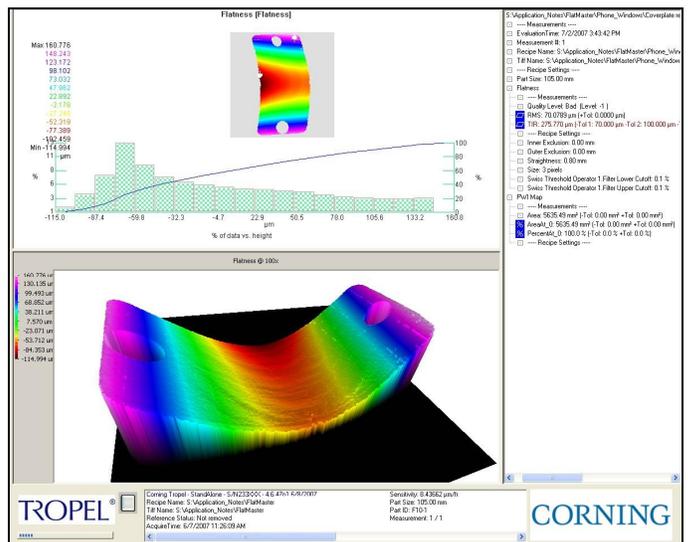
Using a new series of laser frequency algorithms, it is now possible for the FlatMaster system to measure a broader range than ever before.



Histogram: "Passing" and "Failing" Cover Glasses



A very flat cover glass at 54 µm.



With a flatness of 306 µm, this cover glass is out of tolerance

3) Although this isn't a typical FlatMaster precision application, the high volume easily justifies the system cost.

Feeler gages obviously cost less than a Tropel FlatMaster system. However, the opportunity cost of false failures easily justifies the higher initial cost. The improved accuracy and reduced scrap rate using a FlatMaster system will quickly payback the initial cost. The question is *how quickly?*

Here's an example with moderate assumptions:

Assume a manufacturer produces 20,000 units a day. 30% (6000 parts) are failed by the feeler gages. If a FlatMaster system recovers 95% (the false failures), that's 5700 parts returned to production. At a theoretical cost of \$1 per unit, a FlatMaster will pay for itself in <30 days.

Double both numbers (40,000 units a day, at \$2 per unit) and the FlatMaster will generate almost \$23,000 per day, paying for itself in less than one week.

Conclusion

The Tropel FlatMaster system is an investment that any metrology operation can incorporate with confidence. It is highly reliable, more accurate, and faster than competitive techniques. The customer in this example was so impressed they bought multiple units, just to double-check the "failed" cover glasses and recover parts that were falsely failed by their standard process.

Corning Tropel Corporation

60 O'Connor Road
Fairport, New York 14450
tel: 585 388 3416
fax: 585 388 3414
email: metrology_info@corning.com
web: www.corning.com/specialtymaterials

The logo consists of a solid blue square with the word "CORNING" written in white, uppercase, serif font, centered within the square.