



**WAFER  
WORLD**

I N C O R P O R A T E D

Then and Now



## Wafer World History

### TIME-LINE

- 1996-Wafer World Inc. was founded as a tightly held private company by Sean Quinn.
- 1997- Wafer World acquired the assets of Micron Surface Engineering (West Palm Beach, FL).
- 1998- Silicon CZ and FZ 25.4 mm-150.0 mm In-House wafer polishing
- 1999- GaAs Reclaim 25.4 mm-150.0 mm In-House wafer polishing
- 2000-Germanium 25.4 mm-150.0 mm In-House wafer polishing
- 2001- Sapphire and Quartz 25.4 mm-150.0 mm In-House wafer polishing
- 2002- Wafer World Inc. became an exclusive distributor for ePAK Clean Room Packaging 50.8- 150.0mm
- 2003- Thin Silicon Wafers (MEMS) 25.4 mm-150.0 mm x 10-100 micron production line started
- 2004- On Line 24-7 Shopping Cart Purchase wafers from our stock list
- 2005- Wafer World expands facility, Doubles Production Area and Employees
- 2006- Wafer World was chosen as key supplier of the year by Raytheon.
- 2007- Wafer World opens first outside sales office in Boston, MA
- 2008- Wafer World qualifies as a Ge wafer supplier worldwide for European Ge Solar Cells
- 2009- Wafer World becomes ISO9001-AS9100 certified
- 2010- InP 25.4 mm-150.0 mm In-House wafer polishing
- 2012- \$1M in clean room upgrades, state of the art megasonic wet bench and Particle Counter
- 2013- Purchased a laser marker to service our customers
- 2014- Wafer World triples capacity with the addition of 2 new 15B Double Side Polishers
- 2014- \$2M investment in NEW ISO 5 Clean Room and facility

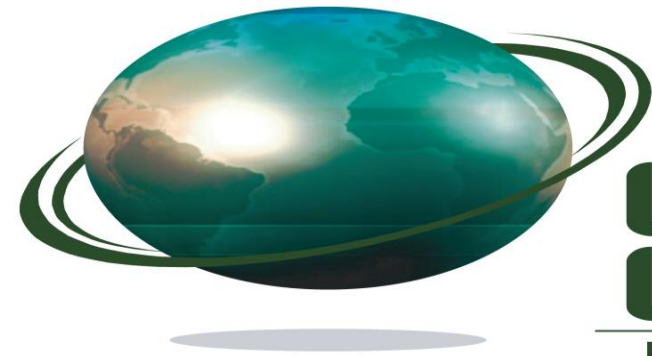


## MISSION STATEMENT

Wafer World, Inc. is a custom materials manufacturing company which focuses on understanding and satisfying the needs and expectations of its customers through aggressive marketing and superb sales management.

We, at Wafer World, Inc. are committed to meeting and exceeding our customer's specifications through sound environmental management practices and strict adherence to industry-recognized quality assurance procedures and documentation.

By establishing mutually beneficial relationships with our customers, Wafer World, Inc. is dedicated to becoming the most diversified substrate manufacturer in the world.



**WAFER  
WORLD**  
I N C O R P O R A T E D

**Wafer World has Five main production areas:**

- 1. Silicon Wafer**
- 2. GaAs Wafers**
- 3. Germanium Wafers**
- 4. Sapphire/Quartz**
- 5. Clean Room Products**



# GaAs Reclaim: Recent Surge!



*Gallium Arsenide*



## **Reclamation of GaAs Wafers by Chemical Stripping & Polishing**

Harvey Kitzmiller, Process Engineer & Sean Quinn, CEO  
Wafer World, Inc., West Palm Beach, Florida, USA

### **Abstract**

Gallium Arsenide (GaAs) is one of the most important compound semiconductor materials in the world, and it has wide applications in wireless, opto-electronics, and Solar Cells. As a cost-savings measure, companies are forced to re-use substrates when feasible. Most of the major GaAs companies in the United States have reclaimed 4" and 6" GaAs wafers for many years. Diameters of 2", 3", 4", 5" and 6" wafers can be processed and re-polished. Process Monitor wafers or Production-Rejects can be reclaimed 2-3 times and used as Test Grade material. Wafers with layers consisting of epitaxy, photo-resist, metal coating, dielectrics, etc. can be reclaimed 2-3 times as well! The process flow chart for reclaim wafers at Wafer World, Inc. is presented. The economical benefits for reclamation of GaAs wafers are discussed in this paper as well.



# GaAs Recycling: Saves \$\$

- Wafers can be processed more than once for additional savings
- diameters up to 150mm diameter
- 3-step polishing process for high quality finished product



## Why waste?

Prime \$\$ on Prime wafers

When you can have your used  
Gallium Arsenide Recycled  
into

Mechanical-Test Grade Wafers  
for all your calibration needs....



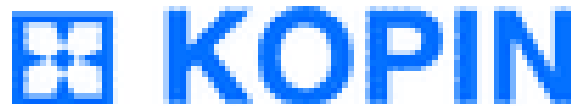


*Gallium Arsenide*

## **Reclaiming GaAs Wafers**

**As GaAs wafer usage continues to rise, GaAs reclaim becomes an even more important cost savings tool – allowing your company to decrease prime wafer purchases.**

*GaAs Industry Leaders*  
*and Satisfied Wafer World, Inc.*  
*Reclaim Customers*



***See Our Website, [www.waferworld.com](http://www.waferworld.com)***

## **Reclamation of GaAs Wafers by Chemical Stripping & Polishing**

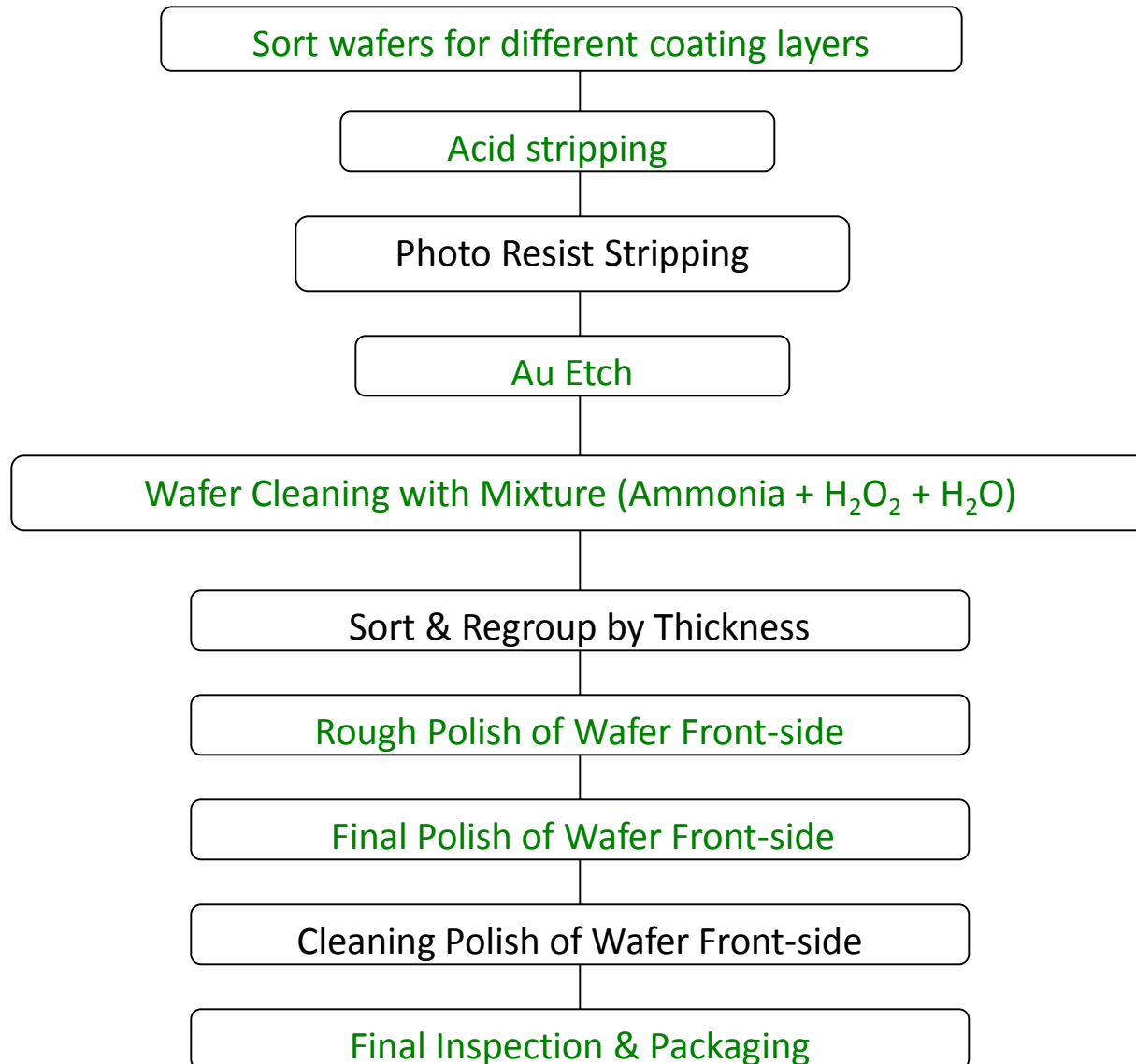
Harvey Kitzmiller, Process Engineer & Sean Quinn, CEO

Wafer World, Inc., West Palm Beach, Florida, USA

### **Abstract**

Gallium Arsenide (GaAs) is one of the most important compound semiconductor materials in the world, and it has wide applications in wireless, opto-electronics, and Solar Cells. As a cost-savings measure, companies are forced to re-use substrates when feasible. Most of the major GaAs companies in the United States have reclaimed 4" and 6" GaAs wafers for many years. Diameters of 2", 3", 4", 5" and 6" wafers can be processed and re-polished. Process Monitor wafers or Production-Rejects can be reclaimed 2-3 times and used as Test Grade material. Wafers with layers consisting of epitaxy, photo-resist, metal coating, dielectrics, etc. can be reclaimed 2-3 times as well! The process flow chart for reclaim wafers at Wafer World, Inc. is presented. The economical benefits for reclamation of GaAs wafers are discussed in this paper as well.

# GaAs Reclaim Process Flow Diagram





Then



Wafer World was found to be non compliant after our first initial test sample was performed in December 2011. The noncompliance was for Arsenic due to our GaAs Reclaim Polishing Service. The reading was a 6.3 mg/L, well over the limit of 0.3 mg/L.

Wafer World implemented a plan very quick to solve this issue. We contacted Siemens for a process to remove the Arsenic from our waste stream. We spent a lot of money to bring in this system in as fast as possible, we didn't want any delays in production.

Wafer World had to change the way we treated all our waste water, not only in the GaAs waste stream, but the entire facility. We manufactured collection tanks, we call them frog ponds, for each production area and pumped all waste to a holding tank to be treated. Wafer World purchased an Arsenic test kit to test the waste stream for Arsenic limit on a weekly basis.



We found that the resin tanks, which are very expensive to recharge, lost it's ability to remove Arsenic at an alarming rate.

After running the system we found that the polishing slurry we use for our process was causing the resin to become ineffective after a short amount of time, causing us to replace the resin sooner than we anticipated.

Wafer World called in another expert, Jamtech Water Services, a company out of Miami, FL. to review our system. We were told that the best method to make the Arsenic resin last longer would be to remove as much of the slurry as possible before it reaches the Arsenic resin tanks.

Wafer World added one addition collection tank to capture the waste water from this one department that was producing the Arsenic. We did this so we did not have to treat the entire facility for Arsenic as the other departments do not produce Arsenic residual.



Below is an outline of the slurry and Arsenic removal system...

## WAFFER WORLD ARSENIC SYSTEM PARTS BREAK DOWN

This system has a 2 step process. The first part of the system removes the silica (Polishing Compound). The second part removes the Arsenic.

1. Multi Media System. – Removes dirt, silt, rust and other suspended particles from the water stream down to 20 Micron. Media includes - Filter AG.
2. Carbon tank. – Removes organic, oils and chlorine from the water system. Media – 12x40 high activated carbon.
3. Water Softener – Removes all the Cations from the water stream. Media – Cation resin – Sybron C249.
4. Big Blue Filters – 5 Micron to 1 Micron to 0.35 Micron to 0.2 Micron. This is used to reduce the silica to acceptable levels so that the Arsenic resin can work effectively. – Filter Type – Flow Max.
5. Arsenic Resin – Arsenic Removal. Resin type – Resintech - ASM-10-HP.





## Arsenic Levels since 2011 Tested by Everglades Laboratories

Date	Test Results
12/16/2011	6.3mg/L (Failed)
1/18/2012	0.0125mg/L (Passed)
5/22/2012	3.7mg/L (Failed)
6/22/2012	0.0206mg/L (Passed)
11/20/2012	0.0091mg/L (Passed)
5/15/2013	0.005mg/L (Passed)
8/23/2013	0.0692mg/L (Passed)



## Arsenic Levels since 2011 Tested by Everglades Laboratories

Date	Test Results
4/14/2014	0.0292mg/L (Passed)
10/16/2014	0.264mg/L (Passed)
4/25/2015	????



**EVERGLADES**  
**Laboratories, Inc.**

1602 Clare Avenue West Palm Beach, FL 33401

p: 561 833 4200 f: 561 833 7280 e: [info@evergladeslabs.com](mailto:info@evergladeslabs.com)

[www.evergladeslabs.com](http://www.evergladeslabs.com)





**WAFER**  
**WORKS**  
INCORPORATED



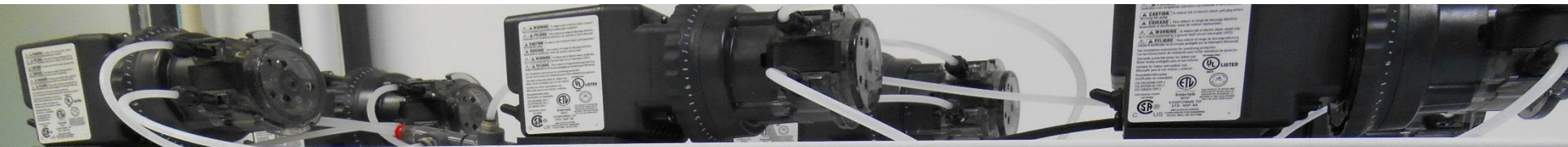


**WAFER**  
**WORKS**  
INCORPORATED





**WORLEB**  
INCORPORATED



REFERENCE ONLY



REFERENCE ONLY



REFERENCE ONLY



3 STAGE  
PH TANK





**WORLEB**  
INCORPORATED

