# Single Wafer vs. Batch Processing of SiC Substrates

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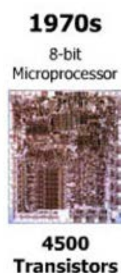
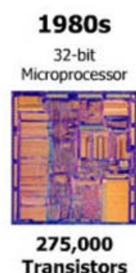
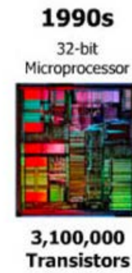
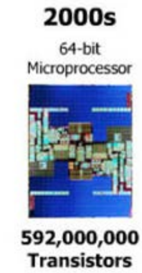
# THE HISTORY

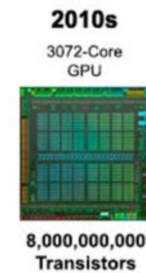
Historically in microelectronics manufacturing, processing was divided into single wafer or batch processing




As linewidths shrank, process specifications became more stringent demanding single wafer control

In similar fashion, substrate requirements for SiC wafers have become more stringent over the years as wafer size increased and device performance improved

**IS SINGLE WAFER PROCESSING THE ANSWER FOR SiC ?**

Single-wafer processing enables more efficient process development because fewer wafers are needed and batch effects are eliminated.

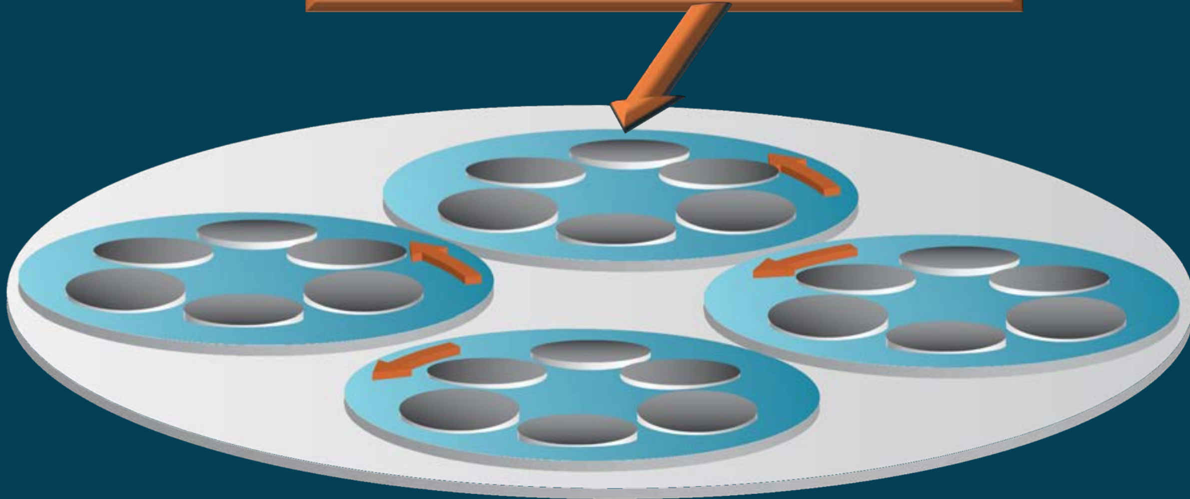
Robotic handling from cassette-to-cassette and *in-situ* monitoring eliminates averaging over a batch leading to a much higher degree of process control than in batch systems.

Single Wafer Processing

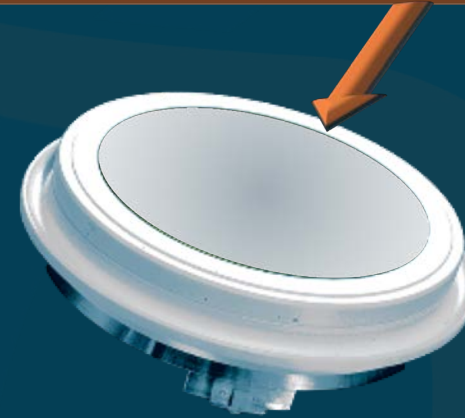
# WAFER SHAPE is more difficult to control in batch processes

The templates and table rotate, wafers are fixed in the template. This causes more material removal on the edge of the wafer located on the perimeter of the template. Single wafer carrier solves this source of wafer shape issues.

More removal on the outer edge creates a wedge shape in the wafers



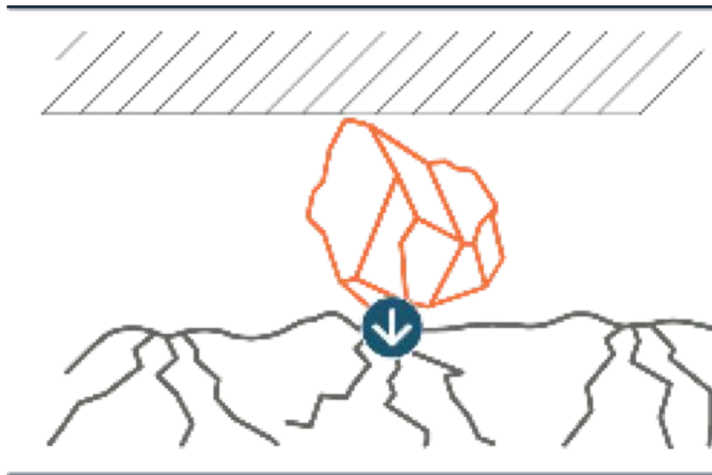
System holds a single wafer. Providing back pressure and vacuum for process and shape control.



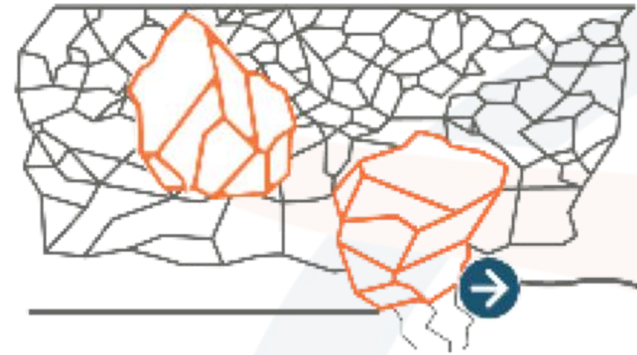
Single Wafer Processing

# Lapping (batch) vs. Grinding (single wafer)

Traditional loose abrasive lapping creates more subsurface damage



Fixed abrasive grinding results in less damage to the wafer

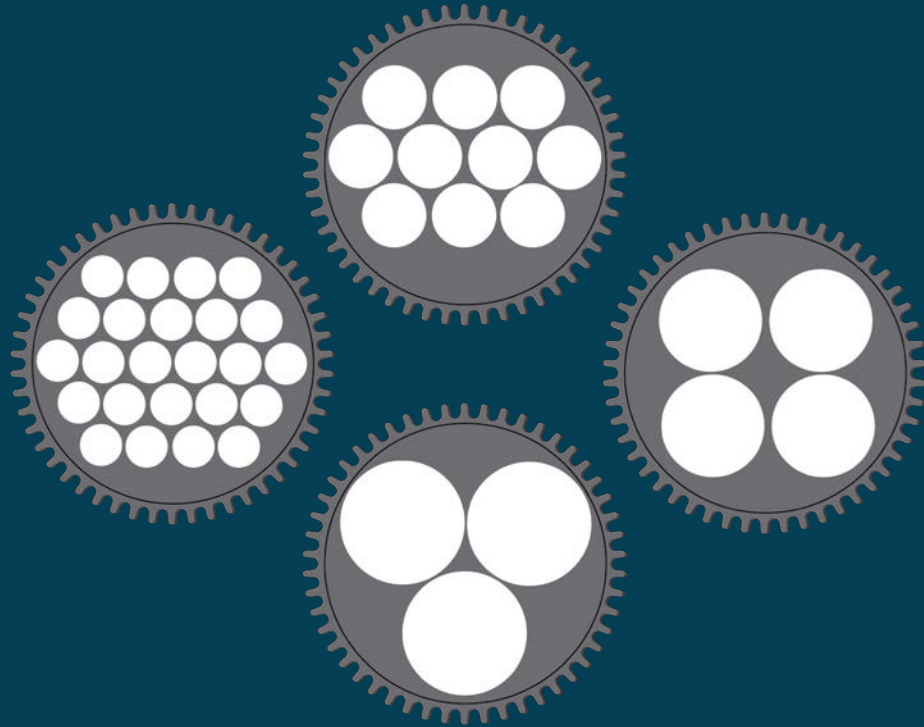


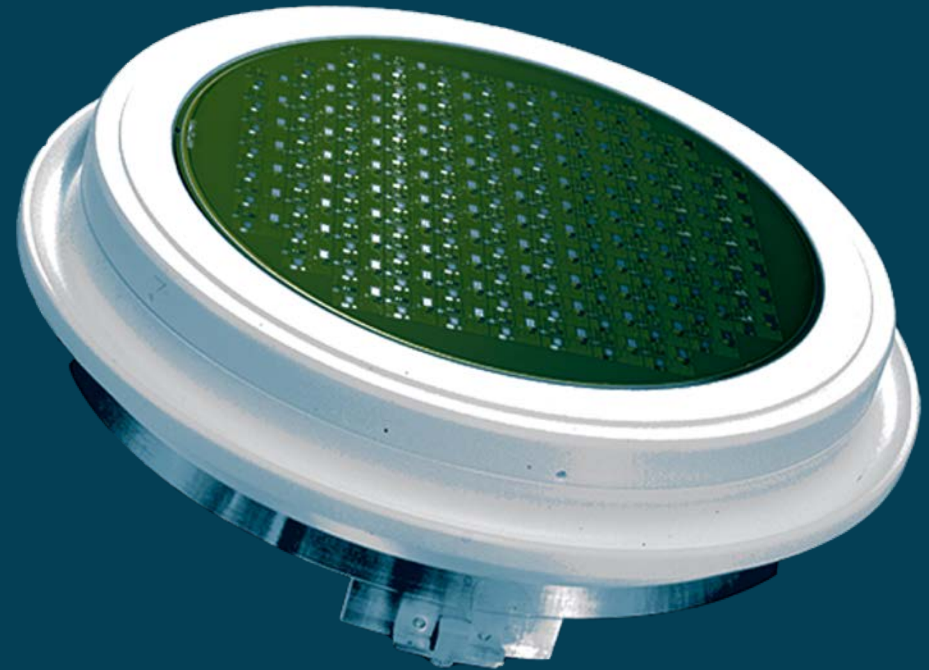
Excess surface damage requires additional material removal. With single wafer fixed abrasive process less material is lost in the process.

Single Wafer Processing

# THROUGHPUT

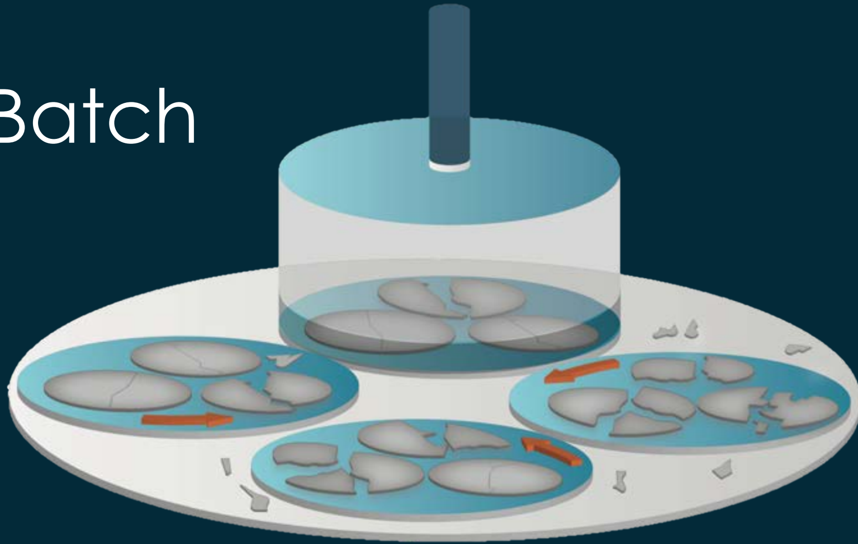
As wafer size increases batch throughput diminishes.





## Batch Wafer Processing

Batch



Struggles to maintain wafer yield

- Batch processing puts many wafers at risk at one time
- Manual load and unload from each batch step (wet wafers are slippery!)

Single

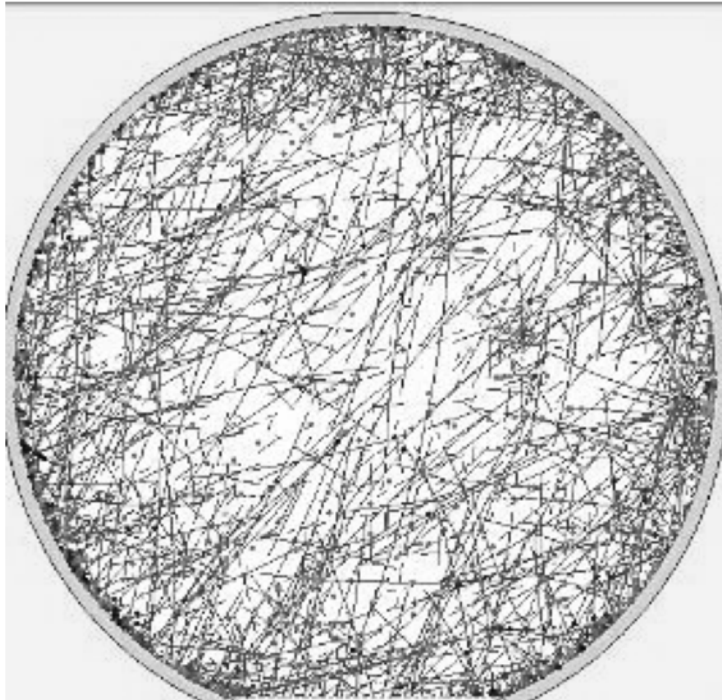
Consistent wafer yield

- Fully automated systems little to no wafer handling

Single Wafer Processing

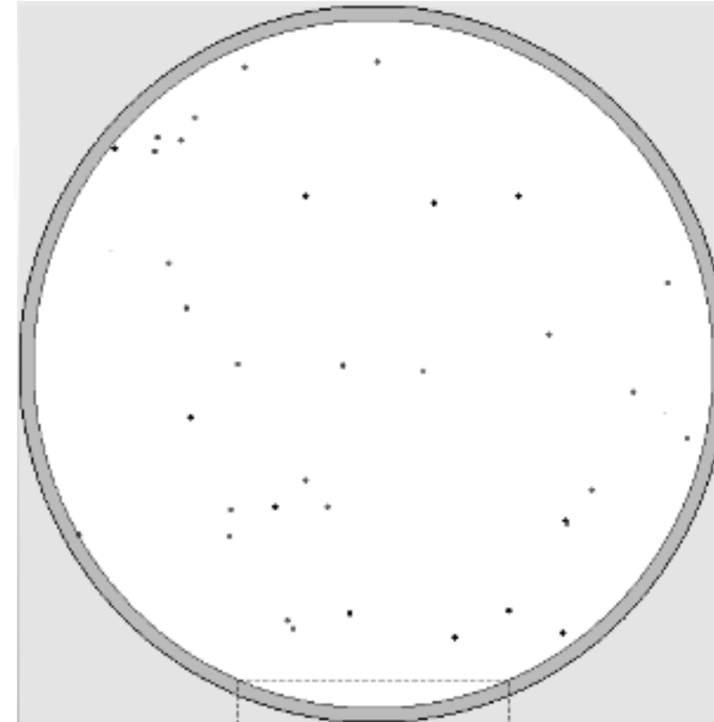
# Batch Polish vs. Single Wafer Polish

**Batch Polish** with
Diamond Abrasive
LaserTec Image



Total Scratches 19999

**Single
Wafer Polish**
LaserTec Image



Total Scratches 0

Single Wafer Processing

# Labor

Labor intensive
Manual load and unload and Wafer sort required

Automated minimal labor needed

## Single Wafer Processing

## Batch
## DIRTY PROCESS

Slurry and debris dry on the wafers during unloading (higher defectivity)

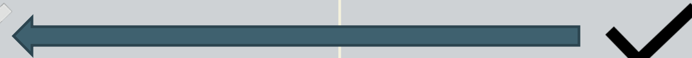
Wafers sit in slurry and debris while being unloaded by hand

As a result, particles dry on the wafers and are very hard to remove with cleaning

## Single
## CLEAN PROCESS

Wet in wet out process keeps slurry and debris from drying on the surface of the wafer

**Single Wafer Processing**

| | Single Wafer Processing SiC Substrates | Batch Wafer Processing SiC Substrates |
|---|---|---|
| Easier Process Development | ✓ | |
| Better Wafer Shape | ✓ | |
| Lapping vs. Grinding | ✓ | |
| Higher Throughput | ✓ | |
| Better Yield |  | ✓ |
| Better Polish Results | ✓ | |
| Not Labor Intensive | ✓ | |
| Cleaner wafer after process | ✓ | |

# Questions Contact:

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