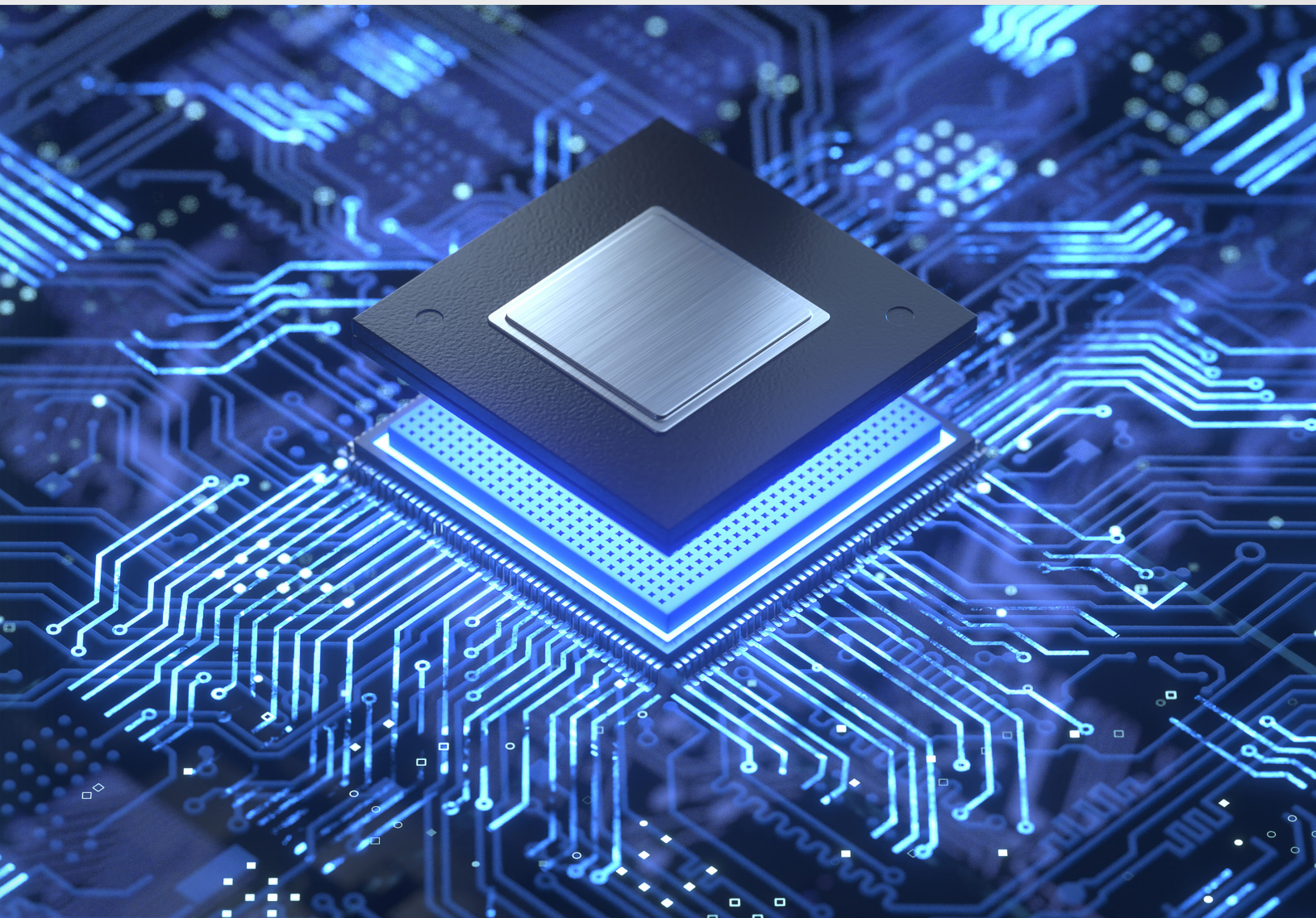




# MULTI-TASK CNC GRINDERS

FOR ADVANCED CERAMICS IN  
THE SEMICONDUCTOR INDUSTRY





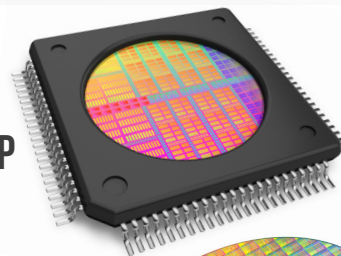
# HARDINGE® STATE OF THE ART CNC GRINDERS

FOR ADVANCED CERAMICS IN THE SEMICONDUCTOR INDUSTRY

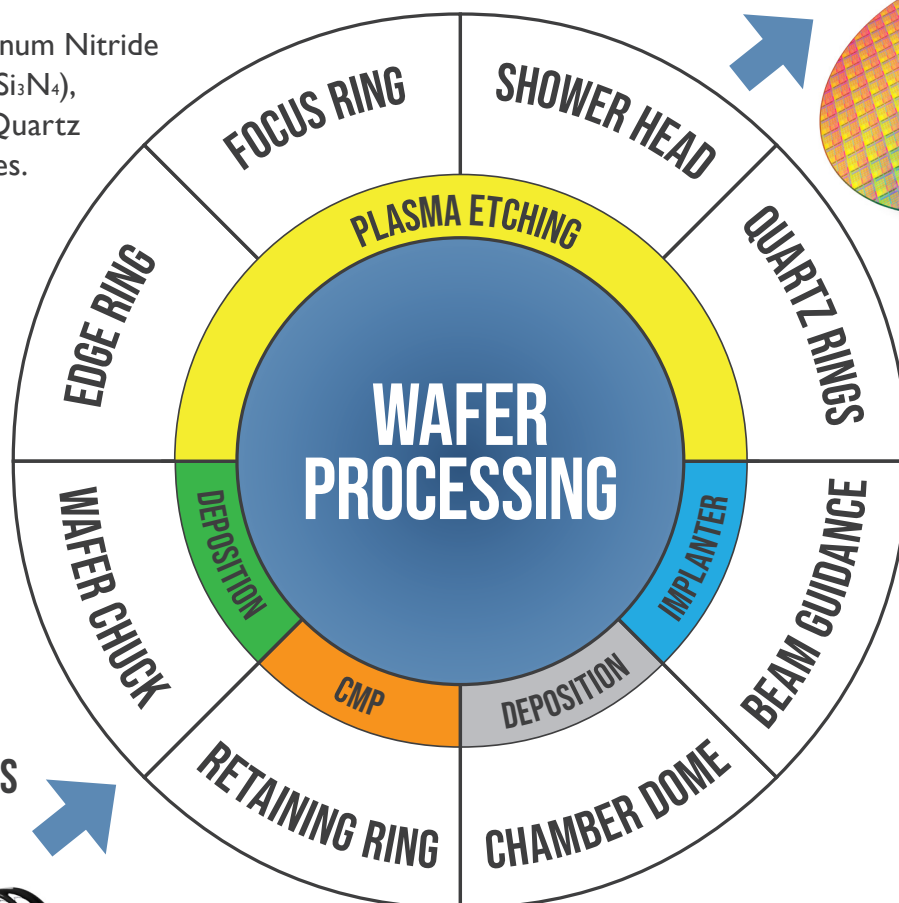
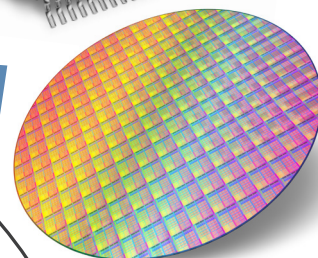


We have extensive knowledge in building **Multi-Tasking CNC Grinders and Integrated Solutions** to grind / mill / drill components such as boules, wafers, silicon electrodes, edge rings, focus rings, electrostatic & vacuum chucks, chamber domes made from **advanced ceramic materials** including single or multicrystal silicon (Si), Alumina ( $\text{Al}_2\text{O}_3$ ), Aluminum Nitride (AlN), Silicon Nitride ( $\text{Si}_3\text{N}_4$ ), Silicon Carbide (SiC), Quartz Glass ( $\text{SiO}_2$ ) and Ferrites.

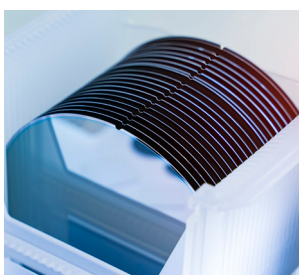
MICROCHIP



WAFER WITH  
PROCESSOR CORES



BLANK SILICON WAFERS  
WITH NOTCHES



BOULES (INGOTS)



HOW DO YOU GET  
**95%+ UTILIZATION**  
OUT OF MACHINES?

# SMART MACHINING TECHNOLOGY

To be successful in the semiconductor market Hardinge has combined the latest CNC control, measurement, mechanical and machining technology into one platform. By increasing functionality, we can develop automated processes in single setups combining ID, OD, Bevel, Face, Radius, and small feature grinding. This allows customers to achieve higher productivity, surface finishes and consistent part quality when working with the most demanding materials. To support the latest manufacturing trends, Hardinge solutions are integrated with smart technology and intelligent monitoring systems that are ideal for IoT and Industry 4.0. When utilizing these platforms manufacturers can expect streamlined manufacturing processes leading to improved efficiency and productivity.

## HOW DOES HARDINGE DO THIS? HOW DO WE GET A UTILIZATION OF 95% OUT OF MACHINES?

NEW REVOLUTIONARY SMART MANUFACTURING CONCEPTS DEVELOPED BY  HARDINGE

- **High resolution vision system** for complex automatic part orienting – Creation of new part centerline based on existing part features allows eccentric machining process to achieve concentricity based on new centerline found.
- **Tool laser measuring technologies** for all wheels in tool changer and large OD wheels with automatic offset capabilities including compensating for wear of diamond dressing wheel. Next-generation high-speed, high-accuracy lasers are good for fast part set-up and machining process control.
- **High-resolution probing and measurement and feedback systems for automated machining;** to measure critical workpiece characteristics in-cycle including automatic size correction capabilities. Process control can be achieved with closed-loop feedback using probes' data to update offsets directly on machine tool controls. Data from the probe is used to update offsets repeatably and reliably, compensating for common causes of process instability. Probing is an established best practice for maximizing the efficiency, quality, capability and accuracy. Standard routines in our modern CNC control simplify the integration of probing cycles into machining operations and offline tools. These routines, combined with a CAD interface, make the simulation of measurement functions easy.
- **Fully integrated 5-Axis control architecture** to achieve all grinding operation under optimal peripheral approach angles including ability to generate radii using straight wheels thus achieving elevated surface finishes over entire part.
- **Industry leading hydrostatic B/BI axes swiveling technology** for both workhead and wheelhead side for enhanced machine flexibility and to support fully integrated 5-Axis control architecture to achieve all grinding operation under optimal grinding conditions.
- **Multi-spindle technology on same machine platform.** This industry leading solution allows to select powerful lower speed spindles ideally suited for OD/face grinding operations using larger wheels while supporting high-speed spindles to optimize the processing of smaller features without compromising on performance.
- **Automatic tool change spindle for speeds up to 30,000 rpm** mounted on vertical Y axis to be able to complete off-center features in a very efficient manner.
- **Integrated 20 position tool changer for ATC spindle**
- **Flexible wheel dressing** with rotary dresser attached to BI (workhead axis)
- **Machine diagnostics and preventative maintenance** Machine performance measurement and diagnosis is essential to establish a known and repeatable level of process capability. Our laser interferometer and ball bar measurement systems assess, monitor and improve the static and dynamic performance of our CNC machine tools.

# THE RESULTS OF OUR SMART CNC GRINDING CONCEPT ARE:

- UP TO 70% REDUCED  
CYCLE TIMES
- HIGH PRODUCTIVITY WITH  
95% UP-MACHINE TIMES
- REDUCED WASTE  
UP TO 45%
- SMALLER FOOT PRINT



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