

Evolution of CMP Pad Conditioners & Abrasive Technology's Leadership Role

Northern California Chapter of the American Vacuum Society

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### **Historical Perspective**



#### Electroplated - circa 1990



#### 1990s

- Early diamond pad conditioning disks were manufactured using electroplating technology to bond diamond to the substrate.
- EP disks often caused high down time & wafer defects.



## **AT's Entry Into the Market**

Brazed - circa 1995



• AT began manufacturing CMP pad conditioner disks in late 1995.

• AT was approached by an end user seeking to "cut" polyurethane materials.



## **AT's Entry Into the Market**





- P.B.S.<sup>®</sup> brazing process was selected based on its superior crystal retention.
- AT was the *FIRST* to manufacture a brazed CMP pad conditioner.



### **AT: A Natural Leader**



# AT was a natural to take the leadership position in the evolution of CMP pad conditioners



- AT has a deep knowledge of diamond and grinding, which are fundamental to CMP pad conditioning today.
- While CMP pad conditioners have been around since the 1990s, AT has been involved in superabrasives since 1971.



## **AT Overview**







- Founded in 1971 in Columbus, Ohio
- Globally integrated leader in superabrasive grinding products.
- Process-centered organizational structure to facilitate excellent communications and service to customers.



## **AT Markets Served**



- Automotive
- Bearings
- Ceramics
- Composites
- Oil & Gas
- Textiles
- Tires
- Tool & Die
- Toolroom
- Medical
- Stone

- General Industrial
- Ferrite
- Friction
- CV Joint
- Glass Fabrication
- Refractory
- CMP / Electronics
- Aerospace
- Glass
- Lapidary
- Ophthalmics



## **AT's Global Presence**



Headquarters: Lewis Center, Ohio, USA

- Elgin, Illinois, USA
- Johnson City, Tennessee, USA
- Montreal, Quebec, Canada
- Barcelona, Spain
- London, UK
- Colwyn Bay, UK

- Lichfield, UK
- Saltash, UK
- Singapore
- Poland
- Germany
- Taiwan
- China



## Generation #1: 1995-1997



- Introduction of P.B.S.<sup>®</sup> brazed process.
- Early stages featured industrial quality products, but quickly moved to highly engineered and controlled products.
- Use of brazed conditioners resulted in lower cost of ownership & defectivity.



- Continued working with major customers to refine product.
- Inspection parameters fixed & serialization was added to improve traceability.





Generation #3: 1999-2000



- Introduction of Infinity<sup>™</sup> and Infinity II<sup>™</sup> pad conditioners.
- Introduction of RAS (Relative Abrasive Sharpness).
- Introduction of preconditioning.



#### Generation #4: 2000-2001

• Introduction of better temperature control, clean scribe lines & improved process monitoring.





## Generation #5: 2001-2003

 Introduction of Process Infinity<sup>™</sup>-- Tailoring of abrasive, concentration and type allowed the disk to better perform for specific processes.



#### **Conditioner Disks for Tungsten CMP**



### **Generation #6: 2004-Present**





#### Introduction of Infinity v6.1<sup>™</sup>



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## **Product Development Expertise**

- AT is successful at developing solutions to address customers' needs.
- AT has proven strength in sustaining and evolving a product line.
  - **\*** Example is the Two Striper<sup>®</sup> product line.
    - Founded in 1971 as the initial AT product.
    - Has successfully evolved through many generations and applications.
    - Continues today to evolve and grow.
    - Among AT's most successful product lines.



### Collaboration



- Common thread through all generations is involvement & communication with end users.
- Next solutions will come from collaborative work between slurry / pad & conditioner makers.







#### **Lessons Learned**





- In the past, products took many years to develop -- now we require quicker learning cycles, quicker time to yield.
- Learning times of years are not possible as our customers move forward we need to move forward also.



## **Successes - Have Farther to Go**

- "Best in class" of a few years ago is now not acceptable.
- Our focus is to keep the technology moving forward.



#### **100 Mesh Shaping Characterization**



#### **AT's Future in CMP**





- Commitment to continue to move product & technology forward.
- Introduce alternative bonding materials -- hypercorrosion resistance.
- Re-exploration of electroplating -- bringing this technology back to the forefront of CMP.



## **Ready to meet the Challenge!**



Source: EE Times Issue 1252 (Lightspeed Semiconductor)