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.® 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 super-abrasive 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.® 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.
Generation #2: 1997-1999

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

155764 (Disk Serial #)

5511718 (Patent #)

S3410538X (ATI part #)

ATI

2D Bar Code (contains disk serial #)
• Introduction of Infinity™ and Infinity II™ pad conditioners.
• Introduction of RAS (Relative Abrasive Sharpness).
• Introduction of pre-conditioning.
• Introduction of better temperature control, clean scribe lines & improved process monitoring.
• Introduction of Process Infinity™-- 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™

- Oxide CMP**
  - Legacy: 40
  - Infinity v6.1: 70

- Multi-step in-situ Copper CMP**
  - Legacy: 15
  - Infinity v6.1: 45

** Fab Data
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® 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

- Shape A
- Shape B
- Shape C
- Shape D
AT’s Future in CMP

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

Ready to meet the Challenge!

Source: EE Times Issue 1252 (Lightspeed Semiconductor)