



# Engineered Surface Finishing of HVOF Tungsten Carbide









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## **Introduction to Cabot Microelectronics**



#### **Cabot Microelectronics' History**

- 1983 CMP technology invented
- 1990 Cabot Microelectronics established a division of Cabot Corporation
- 2000 Initial Public Offering and Spin-off to
  - a fully independent company

#### **Chemical Mechanical Planarization (CMP)**



**Non-planarized IC product** 



**Planarized IC product** 





#### **CMC's Operations Worldwide**







### **Cabot Microelectronics**

- World Leader in Chemical Mechanical Polishing (CMP) for semiconductor manufacturing
- Substantial investment in fundamental science of surface finishing and formulation design
- All facilities have ISO 9001 and ISO 14001 registration
- Solutions for Si, SiO<sub>2</sub>, W, Cu, Al, Ni,Ti, TiN, Si<sub>3</sub>N<sub>4</sub>, Ta, TaN, Ru, Pt, Ir





# **Chemical Mechanical Polishing**

- Process using slurry (chemical and mechanical), pad (mechanical) and equipment to produce a surface with the desired attributes.
- Slurry colloidally stable, aqueous solution of ceramic abrasive particles and chemistry.
- Pad Working surface, generally polymeric.
- Equipment means of combining the slurry, pad and process parameters to provide consistent results.





## **CMP** Polisher









# Why CMP?

### Advantages:

- Process Simplification
  - Can eliminate need for separate grind, hone and lapping steps
  - Could be combined with other process steps to improve overall process efficiency
- Does not create sub-surface damage to material
- Ability to polish multiple materials simultaneously
- Overall range of surface finish

## Drawbacks:

Time

Cabot

oelectronics

Equipment compatibility



## **Engineered Surface Finishes**



#### Solutions for

Cabot Microelectronics

- Industrial & Medical applications
- Optics
- Optoelectronic (FPD, microelectronics, photovoltaic, LED)





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### **Tungsten Carbide Before & After Polishing**





Before Polishing Surface Roughness (Ra) = 94.5 nm

Surface Roughness (Ra) = 16.3 nm

**<u>Results</u>**: Improved wear, cut quality, service life, less friction





## CMP Polished HVOF Tungsten Carbide



• Part courtesy of J. Devereaux, Naval Depot





# **Additional Capabilities**

- State-of-the-Art Polishing
  - $\lambda/20$  Precision
  - Reference Flats
- **Diamond Machining**
- **Custom Lapping**
- Submicron Finishing
- Prototyping
- **Contract Manufacturing**
- **Cleanroom/Metrology Services**







## **Sample List of Materials**

#### **Existing Capability**

- Tungsten Carbide
- Aluminum
- Stainless Steel
- Copper
- Molybdenum
- Cobalt Chrome
- Aluminum Nitride
- Polysilicon
- Silicon Nitride
- Silicon Dioxide
- Tungsten

#### Under Development

- Fused Silica
- Fused Quartz
- AION
- Silicon Carbide
- Sapphire
- ZnSe
- Germanium



