



More Umicore Materials  
Better LEDs.



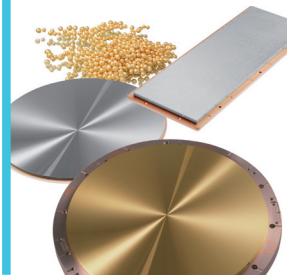
# Umicore materials for electronics contribute to innovation in LEDs



## PRECIOUS METALS CHEMISTRY

### HIGH QUALITY MOS FOR EPITAXIAL GROWTH PROCESSES

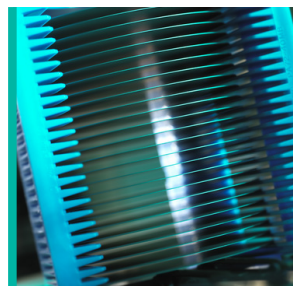
- Products: Trimethylgallium (TMGa) & Triethylgallium (TEGa)
- Features:
- TMGa available in 200l cylinders
  - Central Vapor Delivery
  - Exceptionally stable vapor concentrations
- Benefits:
- Security of supply for critical raw materials
  - Reduction in Total Cost of Ownership
  - Innovative & customized solutions



## THIN FILM PRODUCTS

### SPUTTERING TARGETS & EVAPORATION MATERIALS FOR THIN FILM APPLICATIONS

- Products: Au, Pt, ZnO/Ga<sub>2</sub>O<sub>3</sub>, WTi, ITO
- Features:
- Available as sputtering targets for most cathode designs
  - Available as evaporation material inclusive of accessories
  - Precious Metals up to 4N5
- Benefits:
- Highest quality
  - Application expertise
  - Proven supply record to the industry



## ELECTRO-OPTIC MATERIALS

### DISLOCATION FREE MONO-CRYSTALLINE GERMANIUM WAFERS

- Products: 4" + 6" wafers with a thickness ranging from 140µm -650µm
- Features:
- Ultra-clean surface suitable for wafer bonding
  - One side polished, one side ground and etched
  - High dopants concentration
- Benefits:
- High process yield
  - Very low resistivity
  - Low breakage

## ELECTROPLATING

### HIGH BRIGHTNESS AG PLATING FOR LEADFRAME PACKAGES

- Products: ARGUNA 4500/621/630, Sealing 691
- Features:
- Ultra-high brightness silver layer
  - High temperature resistance
  - Stable plating processes
- Benefits:
- Highest reflectivity
  - Increased efficiency and luminance
  - High yield throughout assembly



## PRECIOUS METALS REFINING

### RECOVERY OF COMPLEX MATERIALS

- Products: Recovery of Au, Ag, As, Bi, Cu, Ni, Pb, Pd, Pt, Rh, Ru, Sb, Se, Sn, Te
- Features:
- Supply of 200 different raw material types
  - State-of-the-art sampling & assaying process
  - Unique & innovative process for recovery of 17 different metals
- Benefits:
- High precious metal yields
  - High sustainability level & environmental standards
  - Closing the loop for LED materials within the Umicore group



## TECHNICAL MATERIALS

### HIGH PURITY EVAPORATION MATERIALS FOR METALLIZATION & CONTACTING

- Products: Au & alloys as AuAs, AuGe, AuSb, AuSn, Ag, Pt, Pd
- Features:
- High purity products (5N)
  - Customized products & shapes
  - Clean room compatible
- Benefits:
- High & stable process level
  - Consistent quality in industrial scale manufacturing
  - Analytical & application competence
  - Low breakage



## Umicore materials for LEDs...

... ORIGINATE FROM CONFLICT-FREE SOURCES

... CAN BE COMBINED WITH HIGH-YIELD PRECIOUS METALS RECYCLING SERVICES

... GUARANTEE SECURITY OF SUPPLY

... PROVIDE TECHNOLOGICAL COMPETITIVE ADVANTAGE

... ARE FLAWLESS IN QUALITY & PURITY

... COME ALONG WITH APPLIED TECHNOLOGY CONSULTING

### Precious Metals Chemistry

Tel.: +49 6181 59 2471  
chemistry@umicore.com  
www.pmc.umicore.com

### Electroplating

Tel.: +49 7171 607 229  
galvano@eu.umicore.com  
www.ep.umicore.com

### Thin Film Products

Tel.: +423 388 73 00  
sales.materials@umicore.com  
www.thinfilmpproducts.umicore.com

### Precious Metals Refining

Tel.: +32 3 821 71 11  
e-scraprecycling@umicore.com  
www.pmr.umicore.com

### Electro-Optic Materials

Tel.: +32 14 24 57 00  
eom@umicore.com  
www.eom.umicore.com

### Technical Materials

Tel.: +49 6181 59 4869  
technical.materials@umicore.com  
www.tm.umicore.com