

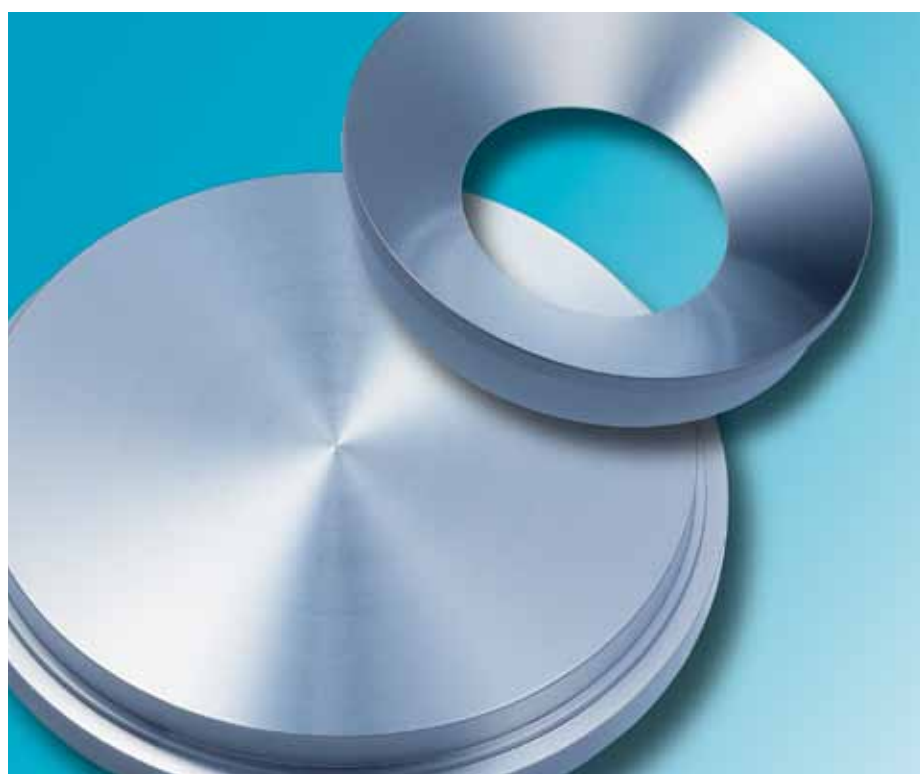
Al and Al Alloys for Semiconductor Applications



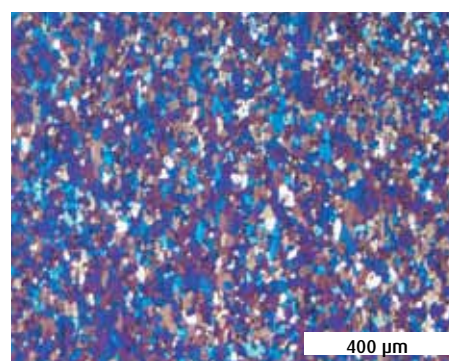
Umicore Thin Film Products

Umicore Thin Film Products, a globally active business unit within the Umicore Group, is one of the leading producers of coating materials for physical vapor deposition with more than 50 years experience in this field. Its Semiconductor portfolio covers a wide range of highly effective sputtering targets and evaporation materials.

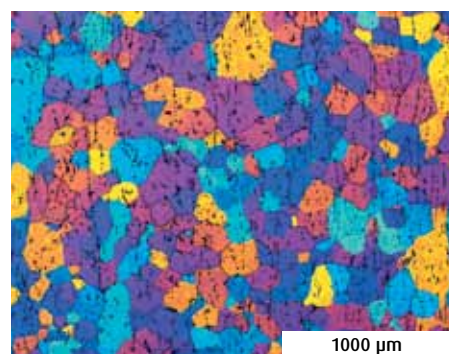
High purity aluminum and aluminum alloys for the Semiconductor technology are used in front end applications as well as for advanced packaging, e.g. Flip-Chip technology, and in a variety of compounds. To match customers needs, Umicore aluminum and aluminum alloy targets are available in several sizes and grades.



Selection of Al Targets



AlCu4, 5N5



AlSi1, 5N5

Al and Al Alloys for Semiconductor Applications

Production Process

Our high purity aluminum and aluminum alloy sputtering targets for Semiconductor applications are melt, alloyed and cast. Special thermo-mechanical heat treatment processes guarantees a uniform structure optimized to the different target geometries.

Analysis

All materials are tested in our leading edge analytical laboratory or in one of our associate laboratories:

- › Glow Discharge Mass Spectrometry (GDMS)
- › X-ray Fluorescence Spectrometry (XRF)
- › Optical Emission Spectrometry (OES)
- › Hot Gas Extraction (LECO)
- › Metallographic Investigation

Alloy Compositions

Al, AlSi, AlSiCu, AlCu as well as almost all customer required compositions are available.

Composition range of selected elements

| |
|----------------|
| 0 – 2 wt% Si |
| 0 – 4 wt% Cu |
| 0 – 0.2 wt% Ti |

Alloying tolerance ± 10 wt% relative

Microstructure

Due to the optimized thermomechanical treatment steps our Al and Al Alloys have a uniform, isotropic grain structure. The average grain size depends of the alloy and the target geometry. Typical micrographs are shown on page 2.

Some typical grain sizes are

| | |
|-------|--------|
| AlCu4 | 25 µm |
| AlSi1 | 200 µm |
| Al | 400 µm |

Purity

Our standard quality for Al and Al Alloys has a guaranteed metallic purity of 5N5 with a controlled U + Th content of smaller than 20 ppb. Also 5N5 qualities not U + Th controlled are available. Other qualities upon request.

Trace Impurities

U and Th govern the emission of alpha particles, which in turn limits the electronic noise of a device through the generation of parasitic charge carriers in the transistor layer. Alpha particles will only be partially absorbed in the layers located between the Al-containing layer and the transistor layer. Therefore the closer the Al-containing layer is from the transistor layer, the lower must be the U and Th content in the target material.

A selection of maximum impurity values for Al 5N5 U + Th controlled is listed below.

Metallic Element

| | | | |
|----|------|------|------|
| Ag | 0.5 | La | 0.5 |
| Au | 0.01 | Li | 0.1 |
| B | 0.2 | Mg | 0.8 |
| Ba | 0.2 | Mn | 0.2 |
| Be | 0.1 | Mo | 0.2 |
| Bi | 0.5 | Na | 0.2 |
| Ca | 0.4 | Ni | 0.5 |
| Cd | 1 | P | 1.5 |
| Ce | 1 | Pb | 0.5 |
| Co | 0.1 | Sn | 0.5 |
| Cr | 0.4 | Ti | 0.5 |
| Fe | 1.5 | U+Th | 0.02 |
| Ga | 0.1 | W | 0.5 |
| In | 0.5 | Zn | 0.5 |
| K | 0.4 | Zr | 0.3 |

Non-Metallic Element

| | | | |
|----|-----|---|-----|
| C | 2 | N | 1 |
| Cl | 1 | O | 10 |
| F | 0.7 | S | 0.9 |
| H2 | 0.2 | | |

All values are listed in ppm.

Dimensions

Due to our dynamic management processes, different dimensions (ø up to 400 mm, length up to 800 mm) can be realized within a short period of time. Targets are available in monoblock or bonded versions.

Bonding

We use our own bonding methods for Al compound targets. The bonding method depends on the different design of the targets and the stability requirements.

Bonding techniques:

- › Special flux free solder technique for recyclable backing plates.
- › Diffusion bonding on Cu or Al backing plates.
- › E-beam welding on Al-alloy backing plates.

Packaging

Final cleaning and packaging is completed under clean room conditions. All targets are vacuum sealed in polyethylene bags, guaranteeing consistent target performance, even when stored for a longer period of time.

Quality Assurance

The Balzers location is certified according to ISO 9001, ISO 14001 and OHSAS 18001 standards. All other production sites are also ISO 9001 and ISO 14001 certified. Documentation, process specifications, traceability, sophisticated analytical methods, and continuously trained employees guarantee the highest and most consistent product reliability.

Please find your local sales partner at:
www.thinfilmproducts.umicore.com

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