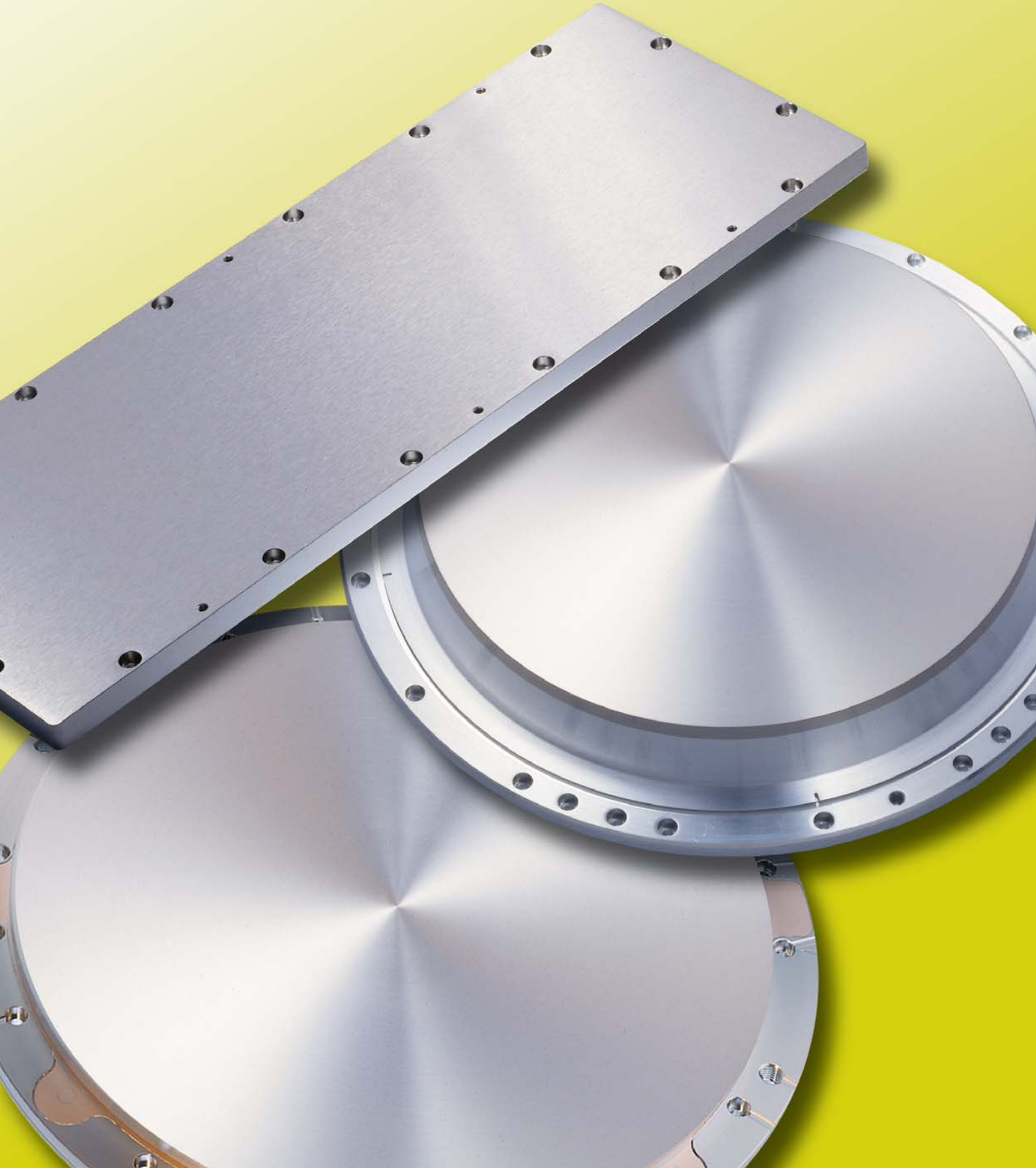


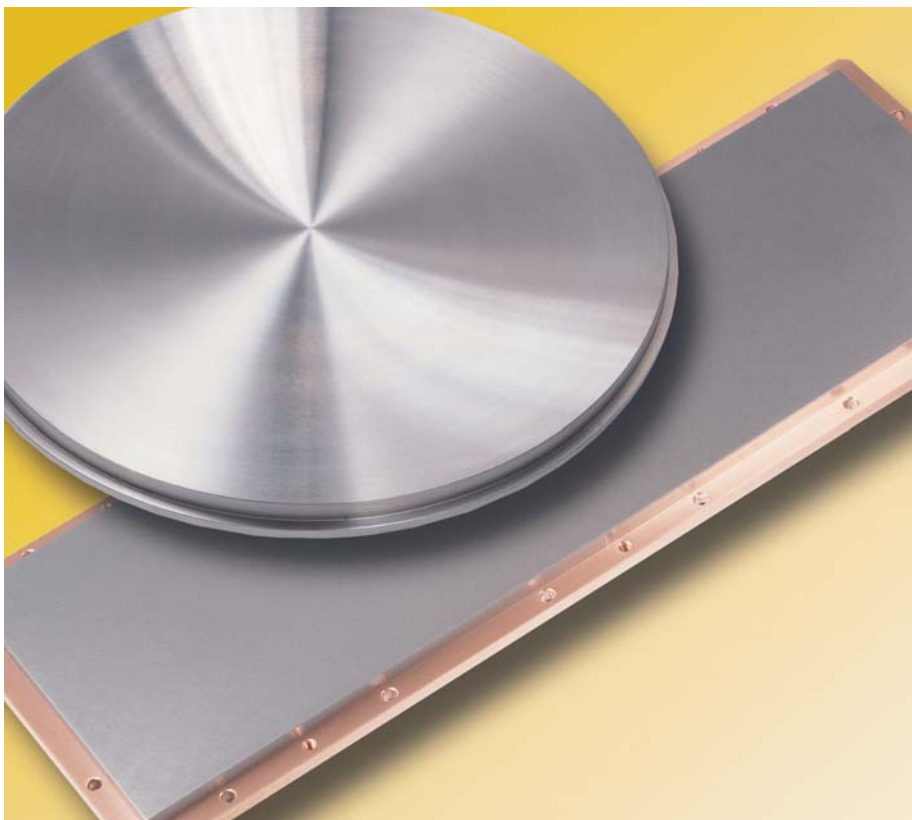
Ti for Semiconductor Applications



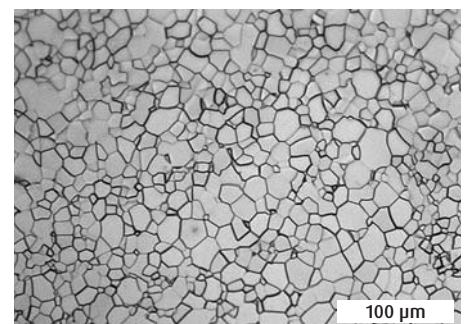
Umicore Thin Film Products

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.

Titanium for Semiconductor technology is used for front end applications as well as for advanced packaging, e.g. Flip-Chip technology, and in a variety of compounds. Umicore Titanium sputtering targets are available in several grades to match customers needs.



Selection of Ti Targets



Microstructure of Ti 4N5

Ti for Semiconductor Applications

Production Process

Our Titanium sputtering targets for Semiconductor applications are E-beam melted. 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:

- › Hot Gas Extraction (LECO)
- › Glow Discharge Mass Spectrometry (GDMS)
- › Induction coupled plasma spectrometry (ICP)
- › Metallographic Investigation

Microstructure

Due to the optimized thermomechanical treatment steps our Titanium has a uniform, isotropic grain structure. A typical micrograph is shown on page 2.

Average grain size 3N grade: 200 µm

Average grain size 4N5 grade: 50 µm

Average grain size 5N grade: 50 µm

Purity

Three different standard purity grades are available: 3N, 4N5 and 5N. This purity grades are tailored to reach the best cost/performance ratio. Other purities upon request.

Trace Impurities

A selection of the maximum impurity values is listed for the three different grades.

Metallic Element	3N	4N5	5N
Ag	1	1	0.2
Al	100	10	3
Au	1	1	1
Ca	20	2	2
Cl	5	5	5
Cr	400	5	2
Cu	50	2	2
Fe	400	20	7
K	1	0.2	0.2
Li	1	0.1	0.1
Mn	30	5	1
Mo	50	5	0.5
Na	1	0.2	0.1
Ni	400	5	2
Si	50	5	2
U + Th	0.005	0.002	0.002
Non-metallic Element	3N	4N5	5N
C	200	50	40
N	100	50	40
O	700	450	250

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

Umicore Thin Film Products uses its own proprietary bonding method, based on a flux-free solder technique. Thin film adhesion and diffusion barrier layers are applied to the back of each target, followed by a temperature controlled metallic solder seal between target and backing plate. The bonding is compliant to accommodate mechanical and thermal stress.

Packaging

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

Quality Assurance

Our quality assurance process is ISO 9001:2000 certified to guarantee the highest and most consistent product reliability. Documentation, traceability, statistical process control, detailed test and process specifications as well as sophisticated analytical methods and continuously trained employees are important elements of our quality assurance process.

