

**Product information**

## Extended processing lifetime in semiconductor technology TECATRON CMP & TECAPEEK CMP

***Lightweight, versatile plastics have a proven track record stretching back over many years in the processing and testing of semiconductor products. Their success is based on a combination of material benefits which are brought to bear even under harsh chemical or different temperature level conditions. Moreover the trend to even smaller and more powerful integrated circuits (ICs) raises new challenges to the entire production chain, from cutting the raw wafer to the final testing stage, which can be met by the deployment of technical plastics.***

In the process of semiconductor production, technical plastics can be used in a wide range of applications. The special demands imposed upon these materials are addressed by the outstanding properties of high performance plastics:

- High thermo-mechanical strength
- Minimal thermal expansion
- Good wear resistance
- Good chemical resistance to acids, alkalis, greases and solvents, hydrogen peroxide, demineralised water, hot steam
- Good plasma resistance
- Minimal out-gassing under vacuum

**Function:**

The Chemical Mechanical Planarization (CMP) process is one of the key steps in silicon wafer production. With the migration towards larger wafer sizes, smaller chips with narrower line widths and feature sizes, engineers are always searching for new materials to meet their needs. Therefore CMP applications require an outstanding product performance in many different areas, such as high chemical resistance to slurries, high wear rates, increased sensitivity to contamination sources and an excellent overall process performance during the total lifetime of the ring.

**Benefits:**

- With its specialized and broad portfolio of materials for CMP applications, Ensinger can always offer the right product of choice for the best cost of ownership.
- Higher yields and improved throughput due to less microscratching of the wafer
  - Extended wearlife and best in class uniformity results in higher processing and product performance
  - Set up and robust speed, product consistency
  - Overall cost systems reduction and proven return on investment through improved cost of ownership

# Special materials for CMP processes

**Ensinger offers a broad and specialized portfolio for CMP applications. Their specific properties, including material purity, resistance to chemicals and good dimensional stability even at high temperatures are ideally suitable for the manufacture and processing of wafers.**

## **TECATRON CMP (PPS)**

- Higher abrasion and wear resistance compared to TECATRON SE
- Improved toughness and machinability
- Very good chemical resistance
- Very good thermal and mechanical properties
- Long-term service temperature up to 230 °C
- High dimensional stability and low creep tendency
- Low water absorption

## **TECATRON SE (PPS)**

- High dimensional stability and low creep tendency
- Very good chemical resistance
- Very good thermal and mechanical properties
- Long-term service temperature up to 230 °C
- Extreme hardness and rigidity
- Low water absorption

## **TECAPEEK CMP (PEEK)**

- Higher ductility compared to TECAPEEK SE
- Improved tribological properties compared to TECAPEEK SE
- Very good chemical resistance
- Excellent mechanical properties
- High stress crack resistance
- Good dimensional stability and easy machining properties
- Long-term service temperatures of up to 260 °C

## **TECAPEEK SE (PEEK)**

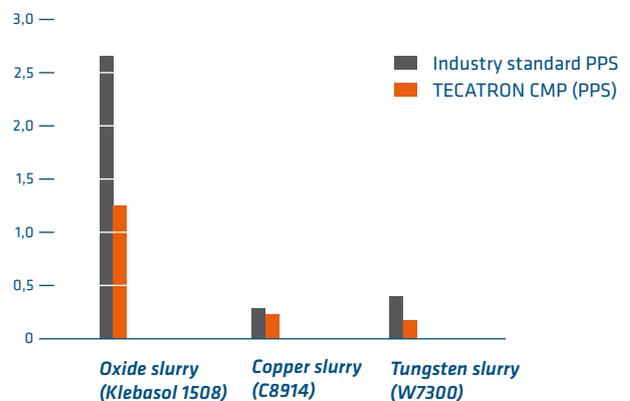
- Very good chemical resistance
- Excellent mechanical properties
- High stress crack resistance
- Good dimensional stability and easy machining properties
- Long-term service temperatures of up to 260 °C
- Excellent tribological properties

## **Wear / lifetime**

TECATRON CMP (PPS) demonstrated a lifetime factor greater than 2x over the industry standard PPS in oxide slurry and superior wear rate also in copper and tungsten slurry, as measured recently on production equipment by Ebara Technology, U.S. Removal rate (including edge)

## **Wear rate, UM/min.**

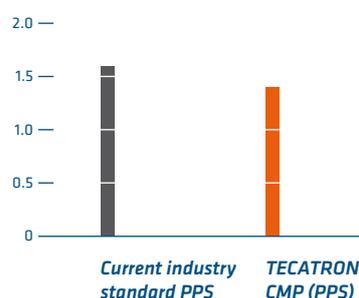
Conditions:  
pad: IC1000K/SubalV; process: TT/TR = 90/91 rpm,  
TRP (RRP) = 5psi, run = 3hrs



## **Removal rate (including edge)**

Recent CMP testing conducted by Ebara Technology, U.S. revealed that TECATRON CMP (PPS) was comparable to the industry standard PPS.

## **WIWNU % (oxide slurry) CS, scan**



## **Defectivity / microscratching**

TECATRON CMP (PPS) has demonstrated superior defectivity and microscratching properties in production tool testing, as performed by Ebara Technology, U.S.

## **Break In Time**

Retaining rings made of TECATRON CMP (PPS) have demonstrated break-in times comparable to current industry standard PPS on production tools at Ebara Technology, U.S.

### Buehler wear testing

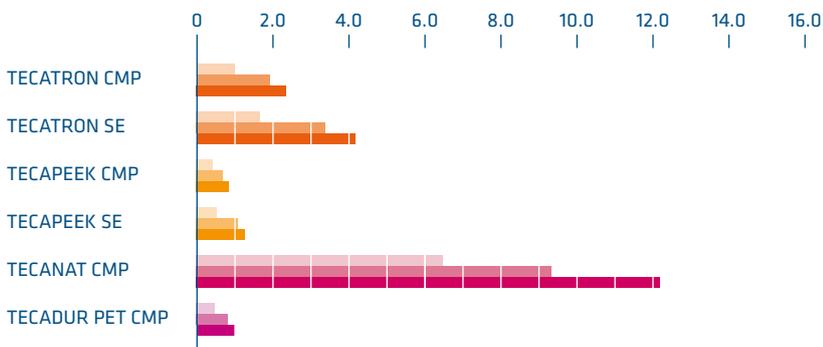
The product lifetime of retaining rings is highly influenced by the material loss under rotation and pressure in the chemical surrounding of the CMP process. This can be simulated with the Buehler wear test. It is a theoretical test which gives indication on the expected behaviour and allows direct comparison of different materials under the same test conditions.

### Buehler wear data

[percent volume material loss]

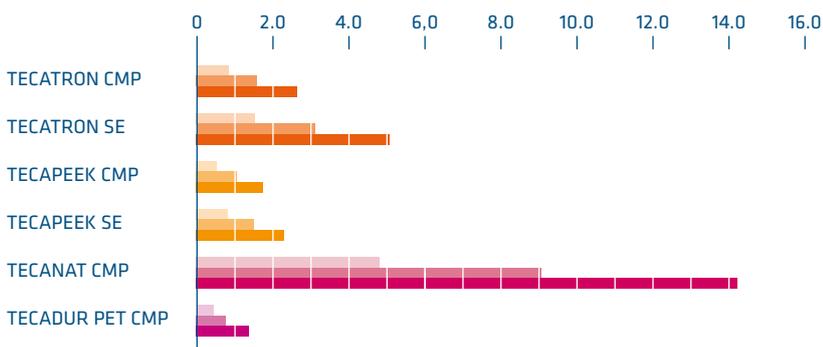
- 8 hours of wear
- 16 hours of wear
- 24 hours of wear

#### Oxide slurry



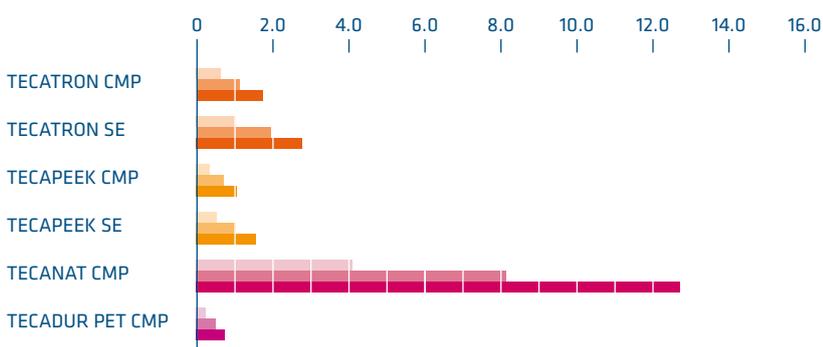
Conditions:  
Semi-sperse SS-12 oxide slurry  
Rodel CR1C1400-A-3 urethane pad  
counter rotating, 150 rpm, 3.8psi

#### Copper slurry



Conditions:  
Copper ready CU3900 slurry  
Rodel CR1C1400-A-3 urethane pad  
counter rotating, 150 rpm, 3.8psi

#### Tungsten slurry



Conditions:  
Tungsten W7300-B21 slurry  
Rodel CR1C1400-A-3 urethane pad  
counter rotating, 150 rpm, 3.8psi

### Technical Properties

Material			TECAPEEK CMP	TECAPEEK SE	TECATRON CMP	TECATRON SE
Chemical designation			PEEK	PEEK	PPS	PPS
Density	DIN EN ISO 1183		1.31	1.31	1.34	1.36
<b>Mechanical properties</b>						
Modulus of elasticity (tensile test)	DIN EN ISO 527-2	[MPa]	4100	4200	3700	4100
Tensile strength	DIN EN ISO 527-2	[MPa]	110	116	102	102
Tensile strength	DIN EN ISO 527-2	[MPa]	50	15	9	4
Elongation at break	DIN EN ISO 527-2	[%]	15/34	23/43	15/33	20/38
Compressive strength (1% / 2%)	EN ISO 604	[MPa]	n.b.	n.b.	94	29
Impact strength (Charpy)	DIN EN ISO 179-1eU	[kJ/m <sup>2</sup> ]	240	253	220	
<b>Thermal properties</b>						
Glass transition temperature	DIN EN ISO 179-1eU	[°C]	151	150	97	97
Melting temperature	DIN 53765	[°C]	340	341		281
Thermal expansion (CLTE), 23 - 100°C	DIN EN ISO 11359-1;2	[10 <sup>-5</sup> K <sup>-1</sup> ]	6	5	7	7
<b>Miscellaneous data</b>						
Water absorption 24h / 96h (23°C)	DIN EN ISO 62	[%]	0.02/0.03	0.02/0.03	<0.01/0.01	<0.01/0.01

n.b. not broken

Data generated directly after machining (standard climate Germany). For polyamides the values strongly depend on the humidity content.

Test specimen to DIN EN ISO 527-2

### Stock items

OD/ID	(mm/“)	TECATRON SE (PPS)	TECATRON CMP (PPS)	TECAPEEK SE (PEEK)	TECAPEEK CMP (PEEK)
360/295	(14“)	●	●	○	○
255/190	(10“)	●	●	○	○
250/200	(10“)	○	○	○	○
230/190	(9“)	○	○	○	○
200/125	(8“)	○	○	○	○
190/140	(8“)	○	○	○	○

● Standard products (from stock or delivery at short notice)

○ Non-standard products (produced to order)

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