

CMP (Chemical-Mechanical-Polishing) System Technical Specification

This specification defines the technical requirements for a CMP system capable of performing chemical-mechanical polishing processes for MEMS, wafer thinning, and surface planarization applications, covering sample sizes from 10 mm x 10 mm up to 4-inch wafers.

1. General System Requirements

- i. The system shall operate based on the Chemical Mechanical Planarization (CMP) principle.
- ii. Processable sample range shall include a minimum sample size of 10 mm x 10 mm and be compatible with 4" wafers.
- iii. The system shall be suitable for research and prototype manufacturing processes.
- iv. The system shall be equipped with an enclosed safety cabinet to protect against chemical splashes.
- v. The system shall be fully compatible with the Turkish electrical infrastructure (220-40 V AC single-phase or 380-400 V AC three-phase, 50 Hz).

2. Polishing Platen

- i. The platen diameter shall be 9.5 inches or equivalent and suitable for processing sample sizes from 10 mm x 10 mm to 4" wafers.
- ii. Platen speed shall be adjustable over a wide range and shall cover the commonly used CMP operational range of approximately 30-100 rpm.
- iii. The platen shall be capable of rotating in both CW (clockwise) and CCW (counterclockwise) directions.
- iv. Pad replacement shall be quick and easily performed by the operator.

3. Polishing Head / Carrier System

- i. Appropriate carriers shall be provided for both 10 mm x 10 mm samples and 4" wafers.
- ii. The system shall allow the use of adapters or fixtures for small samples.
- iii. The carrier's vertical motion (up/down) shall be driven by a motorized or controlled mechanism.
- iv. Polishing head speed shall be adjustable and shall cover the typical CMP operational range of approximately 20-100 rpm.
- v. Downforce/pressure shall be adjustable over a range suitable for both low-pressure polymer CMP and higher-pressure metal/dielectric CMP.
- vi. The system shall include an automatic lateral sweeping/oscillation mechanism to improve surface uniformity.

4. Conditioning Features

- i. The system shall support both in-situ and ex-situ pad conditioning.
- ii. During conditioning, speed and time parameters shall be adjustable.
- iii. Depending on the system design, conditioning motion (oscillation/sweep) shall also be controllable.

5. Slurry Delivery System

- i. The system shall include an integrated slurry supply infrastructure.
- ii. Slurry delivery shall support one or multiple chemicals with adjustable flow rate.
- iii. DI water rinse capability shall be provided.

6. Software and Recipe Management

- i. The system shall operate through a PC-based interface or an integrated control panel.
- ii. It shall allow the creation of multi-step CMP recipes with at least 10 programmable steps.
- iii. Each step shall include adjustable parameters (duration, platen speed, head speed, pressure,

slurry flow rate, conditioning parameters).

iv. Process parameter logging/data recording shall be supported.

7. Surface Roughness Performance

The system shall provide the control precision necessary to achieve the following surface roughness levels, which may vary depending on pad, slurry, and chemical process conditions:

i. Copper (Cu) planarization: Target $Ra \leq 5$ nm

ii. Silicon & SiO₂ surfaces: Target $Ra \leq 2$ nm

iii. Polymer surfaces (SU-8, PI, BCB, etc.): Target $Ra \leq 20$ nm

8. Safety

i. The protection/safety system may be designed with or without a physical lid depending on the manufacturer's implementation; however, it shall prevent operator access to rotating parts.

ii. An emergency stop button shall be provided.

iii. Internal surfaces shall be resistant to chemical exposure.

iv. Overload protection shall be included.

9. Delivery and Training

i. The system shall be delivered with all required components.

ii. On-site installation shall be provided.

iii. Operational, process, and maintenance training shall be delivered.

10. Warranty and Service

i. The system shall be supplied with a minimum warranty period of 1 year.

ii. Technical support (spare parts and labor) shall be available for at least 10 years.

iii. In case of malfunction, remote support shall be provided within 2 days, and on-site support shall be offered within a reasonable intervention period committed by the manufacturer.