Introduction

Through a combination of automated process parameter control and unique processing versatility, the CDP automatic provides repeatable nanometer level accuracy for the majority of materials used in current day device fabrication processes. Due to its accuracy, low CoO (Cost of Ownership) and ease of use, the CDP automatic offers the ideal environment for CMP and Delayering applications.

The programmable control panel can store up to 8 separate material process routes, with an option to increase this to 64 should this extra facility be required. Automated, repeatable planarizing and delayering of ICs, multiple/ individual die and wafers up to a maximum of 8”Ø can be carried out by scrolling through purpose designed control screens.

Description

Capable of being used with both acid and alkaline slurries, the CDP automatic system has been built in a self contained chemical resistant, floor standing cabinet. The process area consists of a 50cm (20”) diameter processing plate, wafer / die carrier and independent conditioner head.

The main process parameters of platen speed, carrier speed, carrier down pressure, back pressure, slurry flow rate and platen temperature can be defined and stored as part of the process route program. Upon starting the CDP automatic the control panel will require that each process variable is entered using the joystick. Once the required option has been entered it is saved by clicking the selection button on top of the stick. These process routes can then be renamed according to the material being processed.

The CDP polishing plate and wafer / die / IC carrier are capable of speeds of up to 160 and 130rpm respectively in either a clockwise or anti-clockwise rotation, whilst the conditioner head is set in a circular holding arm. Direction parameters for both the plate and carrier, again, can be defined and stored as part of the process route setup.

The conditioning block has been designed to ensure that the polishing pad is maintained at its optimal polishing quality and is purposefully set apart from the carrier head to allow “in-situ” pad conditioning without having to disrupt the delayering / planarization process or “ex-situ” conditioning where the pad is conditioned in between delayering / planarization runs. The conditioner sweep is controlled as part of the process setup and can also be switched on or off as required.

The polishing plate is water heated and is controllable between ambient room temperature and 60 degrees Celcius. This enables the chemical activity of the polishing slurry to be altered, allowing for efficient sub-micron material removal of both hard and soft semiconductor / optoelectronic materials.

Available in two different sizes, the wafer / die carrier is suitable for carrying wafers with a maximum diameter of either 4” or 8” respectively. Once the wafer has been attached to the carrier, the desired level of load can be set using the easily operated joystick controls. Back pressure can be applied to the wafer in a similar manner with a maximum setting of 36psi (this may vary depending upon the model) helping ensure an even of polish over the face of the wafer.

The CDP automatic also has an End Point Detection (EPD) System that makes use of custom designed software to allow real time monitoring of the polishing operation without any measurement downtime.

An optional Wet Bench, built in the same style as the CDP machine, is available for the delivery and containment of both polishing slurry and water for cleaning the wafer / die prior to their removal from the processing area. This Wet Bench can be attached to the CDP unit and offers users a convenient alternative for those without in-house containment or delivery systems (waste slurry containment can also be included as part of the modular option).

Applications

The CDP automatic allows the operator to achieve industry standards of control and layer removal for traditional CMOS technology, CMP applications, such as STI and Damascene (acceptable Within Wafer Non-Uniformity (WIIWNU) and Within Die Non-Uniformity (WIDNU) are achievable). The CDP automatic can also be used for non-traditional planarisation applications, such as hard substrate polishing, Epi-ready surface preparation or wafer reclamation, and will produce accurate and repeatable results to within required measurement parameters.

Laser quality surfaces (0/0 scratch dig), improvements to surface topography and Ra to subnanometer levels on substrates are all achievable using the CDP automatic.

This level of diversity makes the CDP ideal for the testing of new CMP slurries, pads and templates for off line analysis and for off line trials of new CMP processes without the need to stop production runs.
Specifications:

- **Power supply:** 220/240V, 50Hz (single phase)
- **Fuse rating:** 16A x 2
- **Plate speed:** 0-160 rpm
- **Wafer carrier speed:** 0-130 rpm
- **Wafer back pressure:** 0-50 psi
- **Carrier down pressure:** 1-9 psi
- **Plate size:** 51cm (20”)
- **Max. plate temperature:** 60 deg C (140 deg F)
- **Height:** 1854mm
- **Depth:** 935mm
- **Width:** 665mm
- **Machine weight:** 534kg
- **Packed weight:** 650kg
- **Plate rotational direction:** Clockwise / anti-clockwise
- **Wafer carrier rotational direction:** Clockwise / anti-clockwise
- **Slurry flow rate:** 20-500mls/min
- **Polishing pad flatness measurement:** +/-10 m
- **Timer:** 0-10 hours

Ordering Data:

1CM51 CDP Chemical Delayering & Planarization System with automated control panel (220V / 50-60Hz)
1CDP41 1CDP41 standard 4” diameter polishing head for use with the CDP Chemical Delayering and Polishing system (240V / 50Hz)
1CDP8 1CDP8 standard 8” diameter polishing head for use with the CDP Chemical Delayering and Polishing system (240V / 50Hz)
1CWB11 CDP Wet Bench (240V / 50Hz)
1PCD1-0100 Lift off plate for the CDP Chemical Delayering & Planarization System

Additional Accessories:

1EPD1 Logitech End Point Detection software

Consumables Data:

0CON-367 Crosshatched grooved expanded polyurethane pads for use with the CDP Chemical Delayering & Planarization System. Suitable for thermal oxide removal (e.g. Silicon Oxide or Silicon Nitride) of wafers 4” or more.
0CON-377 Plain expanded polyurethane pads for use with the CDP Chemical Delayering & Planarization System. Suitable for thermal oxide removal (e.g. Silicon Oxide or Silicon Nitride) of wafers smaller (or greater than) 4”.

Typical Application:

Fault analysis of a Multi Level Metallisation Integrated Circuit

The following pictures are from a device which contains four layers of metal interconnected separated by an interlayer dielectric (insulating layer). These examples show Metal 1 (the lowest metal layer) and were all taken at high optical magnification.

- An example of connection paths to device level (silicon substrate level) as revealed during processing on the CDP system.
- An image taken from the same device as above but highlighting that it is possible to have absolutely minimal edge roll off at the edge of the IC when processing with the CDP.
- This image specifically shows how polishing with the CDP system allows the operator to delayer the IC with both the device layer (lowest level) and Metal 1 showing.