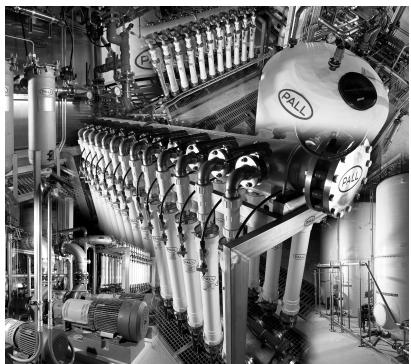


Wastewater Treatment



Microza¹ Crossflow Filtration Systems for Treating CMP Wastewater

The semiconductor industry not only consumes an ever-increasing amount of water but, as a consequence, also ends up discharging large volumes of wastewater. Industrial water consumption, as well as environmental pollution, is being closely monitored by regulatory agencies who are demanding that water consumption be reduced and that discharged wastewater have low levels of suspended solids. In many places, moreover, expansion of production is restricted due to a limited supply of water. Furthermore, the increasing cost of

water, together with fines and surcharges for excessive consumption or discharge, is of growing importance as “green” initiatives gain momentum.

Among the processes requiring large quantities of water and producing significant amounts of wastewater are:

- Chemical Mechanical Polishing (CMP)
- Silicon backgrinding and dicing

It is estimated that reduction, reclaim, and recycling of water from CMP operations would save the semiconductor industry over \$100 million per year due to reduced capital and operating costs. The suspended particles in the wastewater, the majority of which are less than 150 nm, complicate separation by conventional methods (coagulation, settling, centrifugation). Microza hollow fiber membranes remove suspended solids from CMP wastewater without the upstream addition of flocculating chemicals. Thus, operating costs and overall efficiency of processes used in reclaiming water, such as ion exchange, electrodeionization, and reverse osmosis, are greatly improved.

General Process Description

Pall Corporation's technology for the treatment of this waste incorporates Microza crossflow modules. These feature unique double-skinned, hollow fiber membranes. No chemical pretreatment of the wastewater is required to remove suspended solids. Occasionally pH adjustment/control is performed either to reduce the soluble silica levels, precipitate ferric ions for capture by the membranes, or to keep copper in solution. Membrane fouling is minimized by high tangential velocities and periodic reverse filtration with pre-collected permeate. Chemical cleaning is generally performed once every 6 – 12 months. Thus, the use of chemicals is greatly reduced or eliminated, avoiding additional contamination and providing for easy discharge or simplified reclaim.

Pall's wastewater systems are fully automated. They consist of standardized, modular components available for various capacities. They can be tailored with optional features to site-specific requirements and for space restrictions. This approach makes it possible to provide custom-made solutions having an attractive price with low cost of ownership.

¹ Microza is a trademark of Asahi Kasei Corporation.

Feed Water (Wastewater)

CMP wastewater consists of suspended particles of silica, alumina, and/or cerium oxide, typically ranging in concentration from 0.1% – 1% by weight. The silica particles average about 50 – 150 nm in size; alumina particles have a relatively broad distribution, from about 100 to 300 nm. There are varying amounts of dissolved materials present, such as oxidizing agents, inorganic ions, and organic compounds, as well as copper, complexing agents, and corrosion inhibitors in the case of copper CMP.

Permeate

Permeate (filtrate) from the Microza system is free of most suspended solids and chemical additives, other than small quantities of acid or base for pH adjustment. It does, however, contain soluble material such as small organic molecules or dissolved copper that was originally present in the wastewater.

The permeate may be:

- discharged directly to sewage, if it meets local regulations,
- passed to acid waste neutralization, or
- treated to produce raw water or water of a quality suitable for RO make-up, cooling towers, scrubber, or even CMP rinse water. Treatment may include a dedicated RO, ion exchange, carbon beds and/or electrodeionization.

Concentrate

The retained solids are concentrated and reduced 20 – 100 fold in volume. They may be pumped to an existing sludge treatment system or to a dedicated system where they are treated and dewatered.

Copper CMP Wastewater

Pall also provides systems to treat copper CMP wastewater. After removal of the suspended solids, the permeate from the Microza system containing soluble copper is passed through an ion exchange column together with the plating rinse water. The copper solution formed during regeneration of the ion exchange column is combined with the plating bath waste and is either subjected to electrowinning or evaporated to dryness.

Flexibility

As CMP technology keeps evolving, emerging processes will bring changing water and waste requirements. The introduction of copper, as well as new barrier and dielectric materials, may result in different treatment and recovery requirements. Additions to recycle systems may be needed to remove new additives. However, Pall Microza crossflow systems have a flexible design, enabling them to handle changing slurry combinations with only minor modifications, thus assuring many years of useful service.

Microza Filtration Systems for Silicon Backgrinding / Dicing Wastewater

Backgrinding (BG) and dicing (SD) operations consume large volumes of ultrapure water and produce wastewater containing suspended silicon particles. Removal of silicon particles by dynamic membrane filtration facilitates reuse of the permeate (filtrate) following ion exchange or electrodeionization and helps meet environmental discharge regulations. The retained solids, or concentrate, are typically reduced 20 fold in volume.² They may be pumped to an existing sludge treatment system or to a Pall provided, dedicated system where they are treated and dewatered. Pall's BG and SD systems typically operate for up to two years without the need for chemical cleaning.

² For higher concentration of suspended solids, please contact your Pall representative.

Feed Quality

The BG and SD wastewater generally exhibit the following parameters:

Suspended silicon particles	< 500 ppm (BG) < 30 ppm (SD)
Conductivity	3 µS/cm
pH	5 to 6
TOC	< 2 ppm
Dissolved silica	< 3 ppm



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Wastewater Intro.