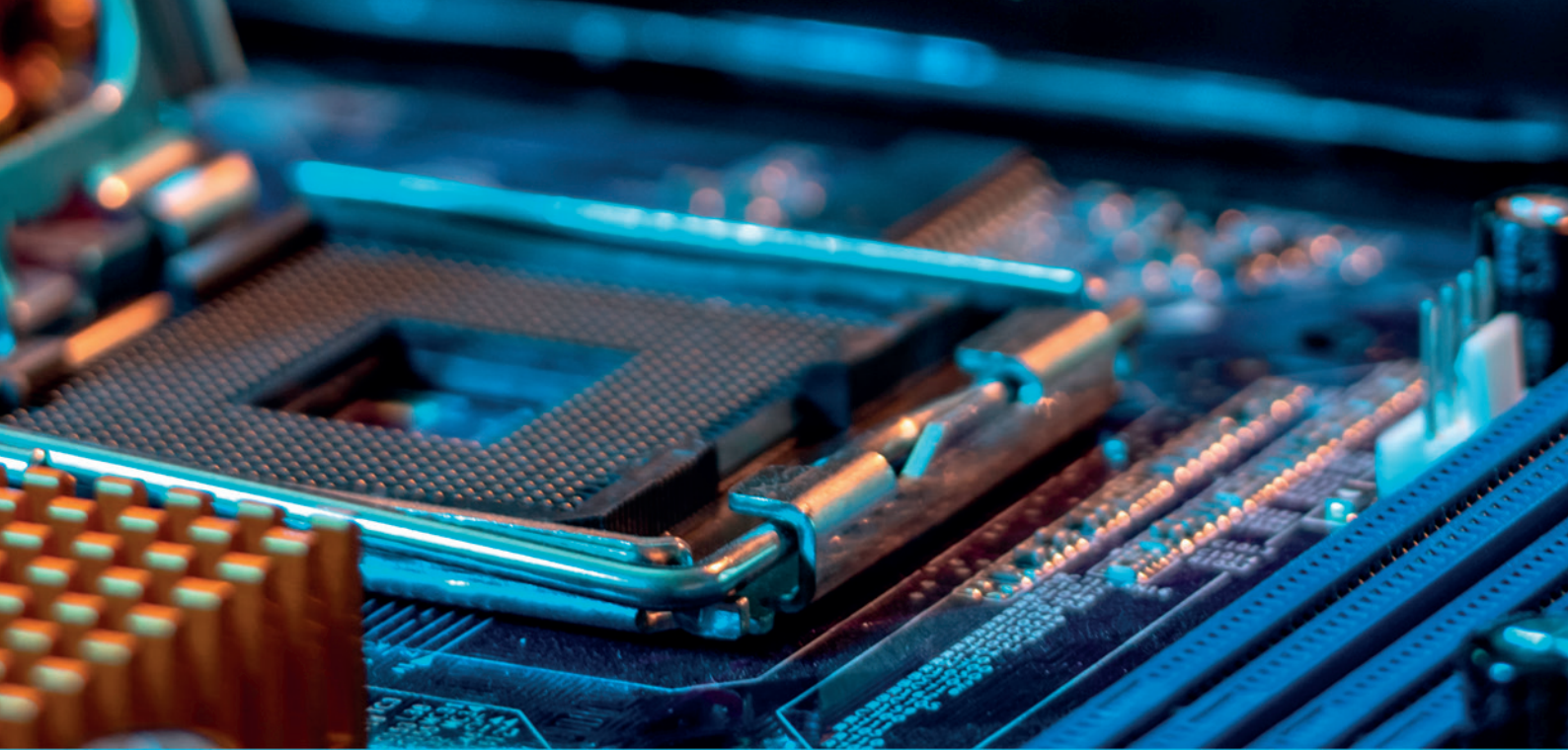
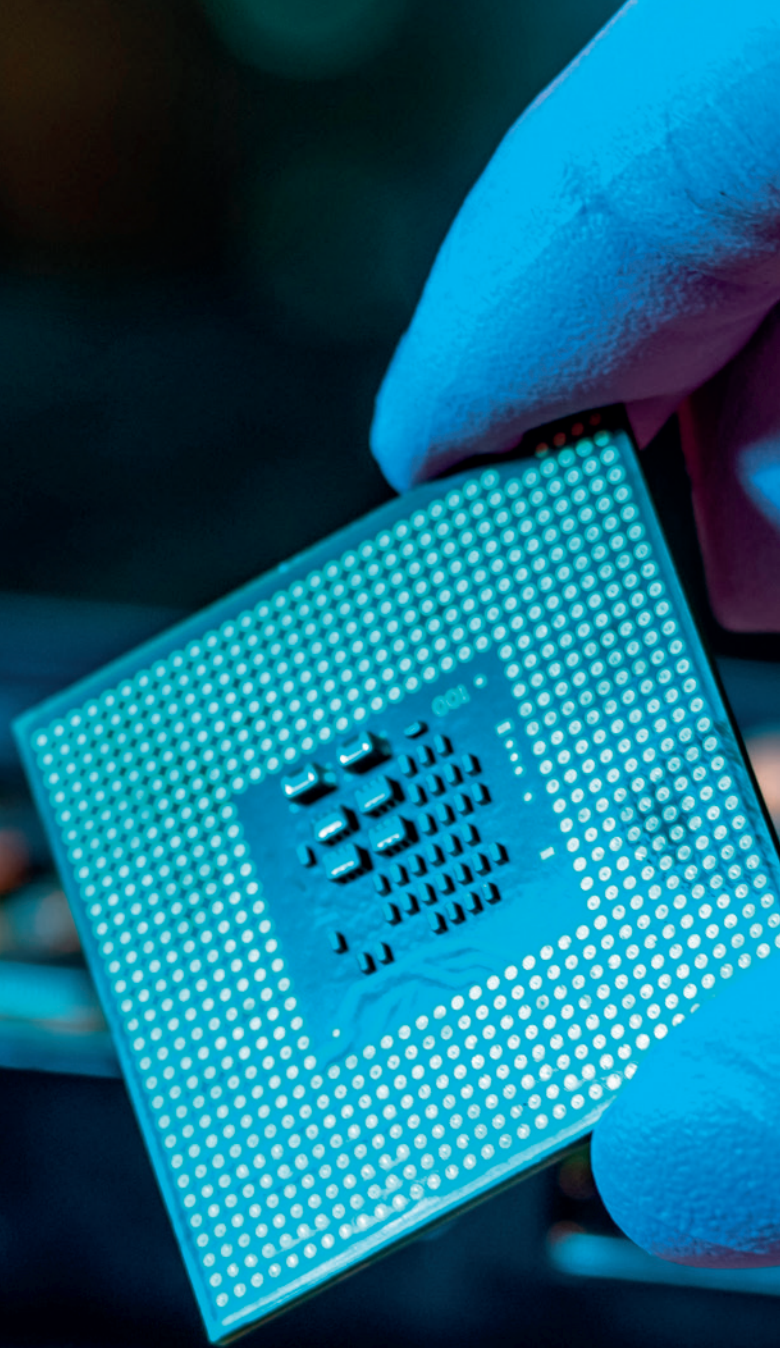


**3M** Science.  
Applied to Life.™

# Moving microelectronics manufacturing forward.



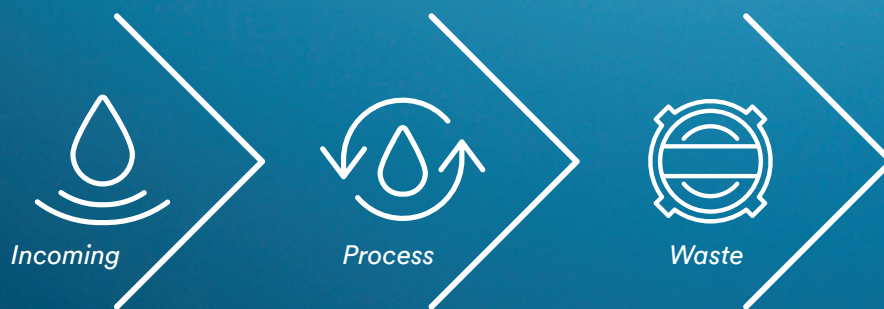


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# Precision you can count on.

When you manufacture microelectronics, you know that precision is critical in Ultrapure Water (UPW) and that the smallest defect can lead to big challenges. Whether it's reducing contaminants in electronics manufacturing, helping to ensure uniform particle distribution, or optimizing your process with reliable and scalable filtration, we have solutions to help you meet strict requirements at every step of your process – and keep you moving in the right direction.



**3M Filtration and Separation Solutions are:**

## **Comprehensive**

The 3M Filtration and Separation product portfolio is made up of high-quality solutions that can be tailored to support your manufacturing processes – from source water to process fluids to wastewater.

## **Efficient**

Easy to change out filters help manufacturers save time and avoid manufacturing disruptions while maintaining or improving quality—making them a smart, cost-effective solution. 3M technical expertise can help support manufacturers' unique filtration needs.

## **Dependable**

High-quality and long filter life help ensure process and product consistency at every step of the manufacturing process.

## **Responsible**

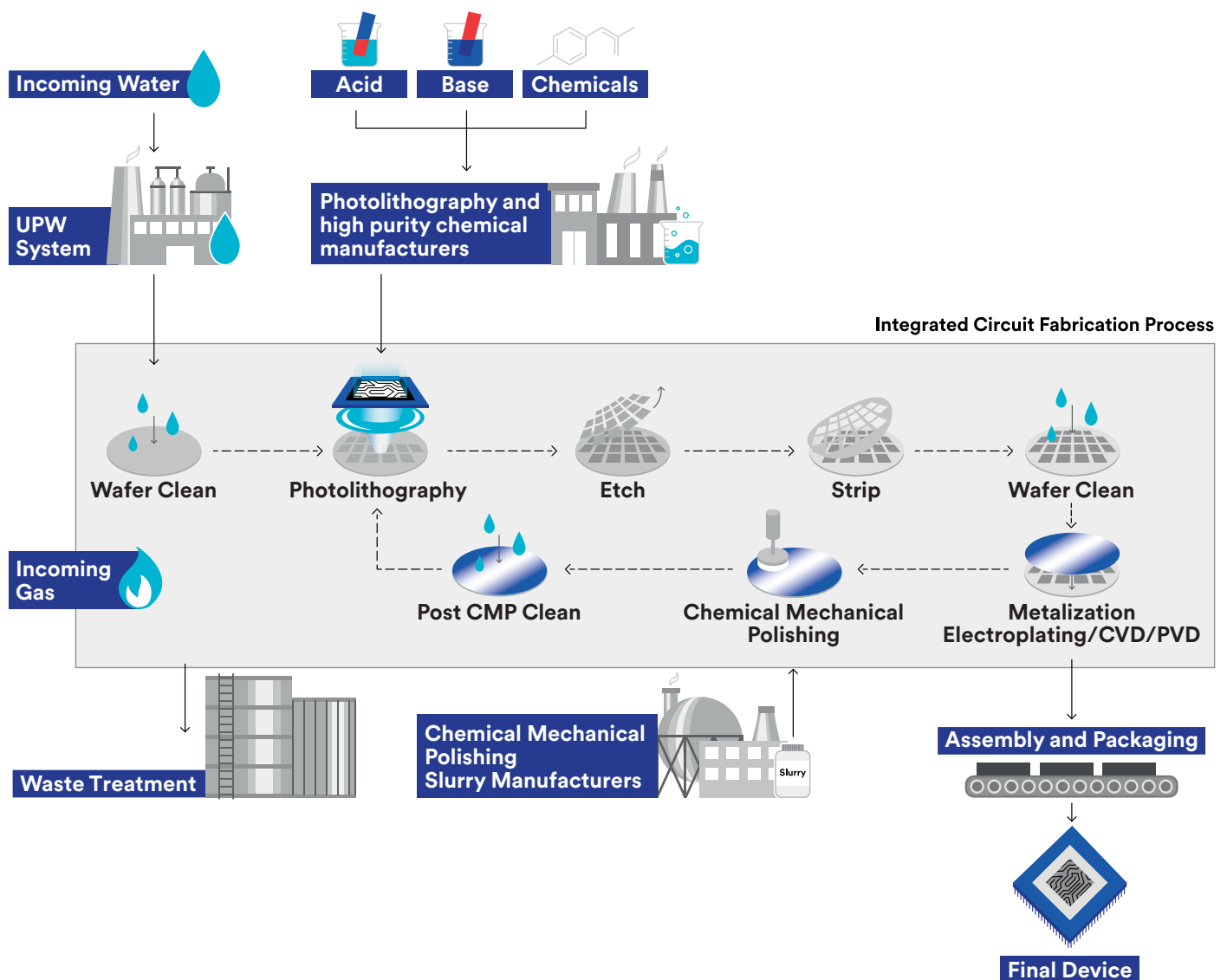
Filtration and separation products from 3M provide high-quality, cost-effective solutions for particle filtration, gas control and sustainable water management from start to finish.



# Semiconductors

Reducing contaminants is crucial in semiconductor manufacturing. Any particles, metals or dissolved gases not removed during production can lead to defects, or even product recalls, later. That's why you need the proven performance of 3M filtration products for every step in your manufacturing process.

## Process Map



## Applications for Semiconductors

### Ultrapure Water

Ultrapure water (UPW) is mainly used to remove defect-causing contaminants from the wafer surface and to rinse or clean wafers after they have been exposed to chemicals during various processes.

3M filtration and gas transfer membrane products help provide the required particle reduction and dissolved gas (O<sub>2</sub> and CO<sub>2</sub>) control to meet the strict requirements of the semiconductor and electronics industry.

### Filtration and Dissolved Gas Control Solutions

#### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

#### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate helps increase the rate of recirculation.

#### 3M™ LifeASSURE™ EMZ Series Filter Cartridge

- ▶ Charge modified nylon membrane helps provide mechanical and electrokinetic contaminant reduction.

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

## Chemical Mechanical Polishing

Chemical mechanical polishing (CMP) is a process to level uneven areas by combining a chemical (acidic or basic) slurry of micro-abrasives with mechanical force provided by polishing. In multilevel metallization processes, as each new metal layer gets added it magnifies the imperfections in the layer just below it.

3M has the filtration solutions to control particle size in the slurries used in the CMP process to allow chipmakers to continue shrinking circuitry needed in next generation devices.

### Filtration Solutions

#### 3M™ Betapure™ AUL Series Filter Capsule

- ▶ Bi-component fiber technology enables Large Particle Count (LPC) reduction.

#### 3M™ Betapure™ NT Series Filter Cartridge

- ▶ Superior particle retention with ratings from 0.5 to 70 micron to suit a range of applications.

#### 3M™ Betapure™ SKYL Series Filter Cartridge

#### 3M™ Betapure™ PPK Filter Cartridge

## Lithography/High Purity Chem

Photolithography is a process used to pattern circuitry on a wafer. Removing unwanted organic contaminants, particles and ionic metal species from high purity chemicals supports the advancement of miniaturization of devices.

Filtration and purification products from 3M allow you to reduce contaminants to help meet the needs of high-performance semiconductor manufacturing.



### Filtration Solutions

#### 3M™ NanoSHIELD™ Hollow Fiber Series Filter Cartridge

- ▶ Provides low operating and differential pressure across the filter to help remove gels and particles down to 5 nm with polyethylene and nylon hollow fiber membranes.

#### 3M™ Metal Ion Purifier

- ▶ Effective reduction of metal ions to <50ppt with higher capacity compared to membrane purifiers.

#### 3M™ LifeASSURE™ BFS Series Filter

#### 3M™ LifeASSURE™ PSN Series Filter Capsule

- ▶ Nylon filter capsule designed for photoresist and ancillary chemical applications.

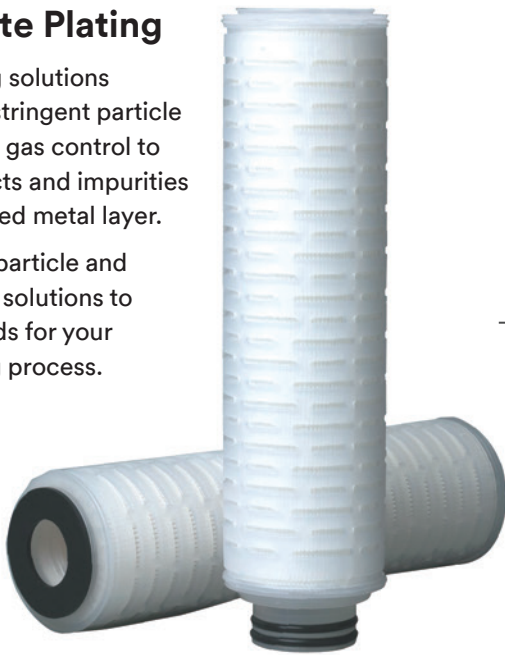
#### 3M™ Betafine™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction provides high surface area and higher product throughputs for prolonged service life.

## Electrolyte Plating

Electroplating solutions require both stringent particle and dissolved gas control to prevent defects and impurities in the deposited metal layer.

3M has both particle and dissolved gas solutions to meet the needs for your electroplating process.



## Filtration and Dissolved Gas Control Solutions

### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

### 3M™ LifeASSURE™ EMC Series Filter Cartridge

- ▶ Downstream cleanliness without IPA pre-wetting and system flushing required.

### 3M™ Betafine™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction helps provide high surface area and higher product throughputs for prolonged service life.

### 3M™ Liqui-Cel™ SP Series Membrane Contactor

- ▶ Utilizes hollow fiber membrane that is impermeable to chemically compatible liquids.

## Wet Cleaning Chemicals

During wet processing, semiconductor devices are repeatedly dipped, immersed, or sprayed with solutions. Even when cleaning steps are performed, the primary reason for device failure is contamination of the wafer surface. As device features continue to shrink, ensuring the purity of acids, bases, and solvents used in the manufacture process will remain critical.

From most acids and bases to alcohols and etchants, 3M has the filter for your chemical application.

## Filtration Solutions

### 3M™ NanoSHIELD™ Hollow Fiber Series Filter Cartridge

- ▶ Helps provide low operating and differential pressure across the filter to reduce outgassing and micro-bubble formation.

### 3M™ LifeASSURE™ EMC Series Filter Cartridge

- ▶ Excellent downstream cleanliness and no IPA pre-wetting and system flushing required.

### 3M™ Betafine™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction provides high surface area and higher product throughputs for prolonged service life.

### 3M™ LifeASSURE™ MFE Series Filter Cartridge

- ▶ Robust PTFE and polypropylene materials provide excellent resistance in aggressive chemicals.



## Wastewater

Manufacturing semiconductors requires large amounts of chemicals, which invariably generates substantial volumes of wastewater. The many different fabrication processes create a variety of wastewater contaminants.

3M has filtration solutions designed to help you filter your wastewater to protect the environment and meet increasingly stringent discharge requirements.

## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ Micro-Klean™ RT Series Filter Cartridge

- ▶ Enhanced contaminant holding capacity for fewer filter change outs.

### 3M™ Betafine™ XL Series Filter Cartridge

- ▶ Features 100% polypropylene construction that provides chemical and thermal compatibility in many demanding applications.

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

## Dissolved Gas Control

3M™ Liqui-Cel™ Membrane Contactors provide efficient dissolved gas control in a compact design. Capable of adding gases to or removing dissolved gases and bubbles from compatible liquid streams, these gas transfer devices utilize hollow fiber membrane technology that help facilities around the world improve operating efficiency and performance and protect product quality.

## Dissolved Gas Control Solutions

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

### 3M™ Liqui-Cel™ SP Series Membrane Contactor

- ▶ Utilizes hollow fiber membrane that is impermeable to chemically compatible liquids.

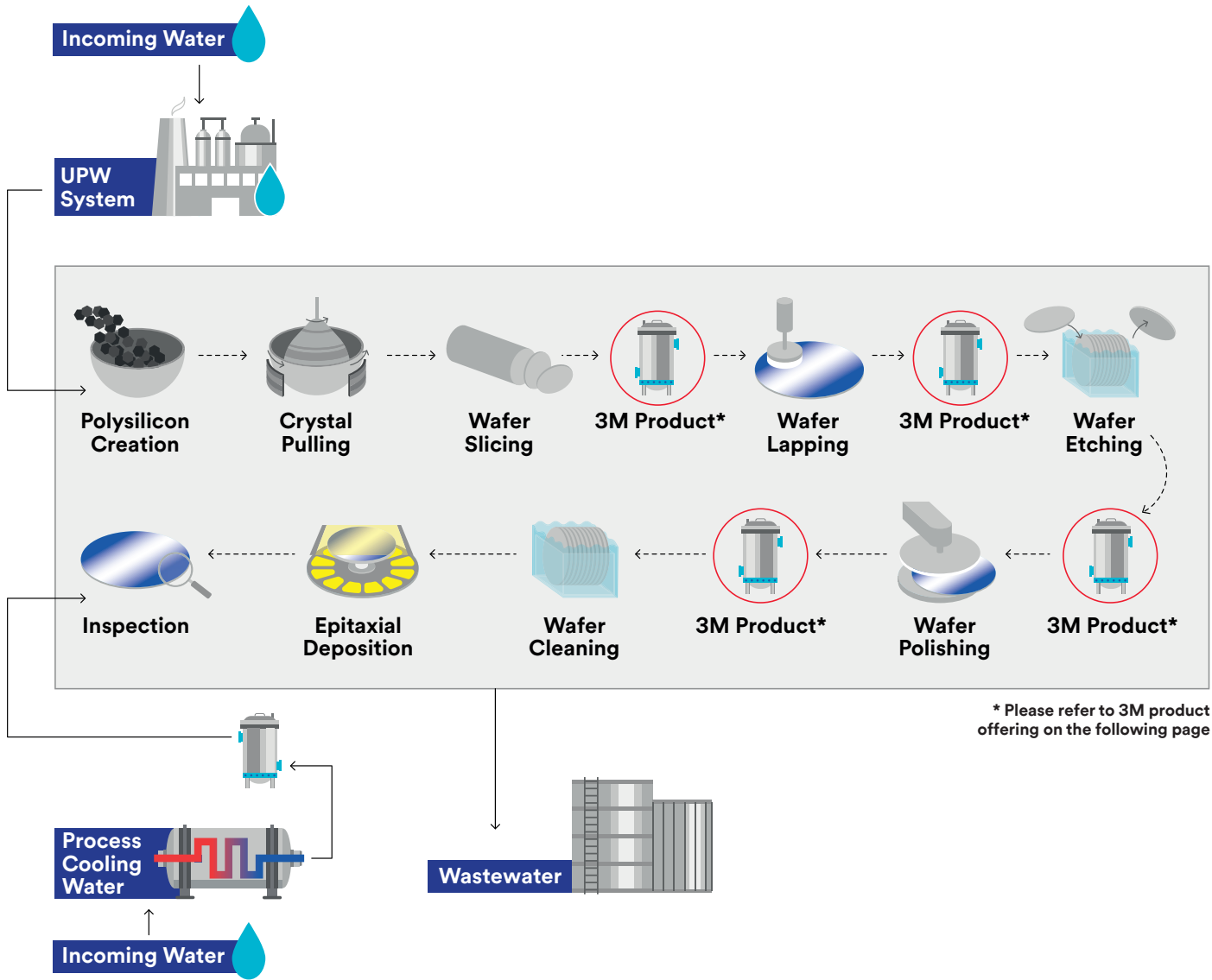




# Silicon Wafers

Silicon wafers are the substrate where electronic circuits are formed to create the integrated circuit which is one of the most essential components of most electronic devices. Increasing levels of filtration performance are needed to meet the strict requirements of today's electronics and semiconductor manufacturing processes.

## Process Map





## Applications for Silicon Wafer Manufacturing

### Ultrapure Water

Ultrapure water (UPW) is mainly used to remove defect-causing contaminants from the wafer surface and to rinse or clean wafers after they have been exposed to chemicals during various processes.

3M's filtration and gas transfer membrane products provide the required particle reduction and dissolved gas (O<sub>2</sub> and CO<sub>2</sub>) control to help you meet the strict requirements of the semiconductor and electronics industry.

### Filtration and Dissolved Gas Control Solutions

#### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

#### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

#### 3M™ LifeASSURE™ EMZ Series Filter Cartridge

- ▶ Charge modified nylon membrane helps provide mechanical and electrokinetic contaminant reduction.

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

## Lapping and Polishing

Lapping and polishing are processes to level uneven areas by combining a chemical (acidic or basic) slurry of micro-abrasives with mechanical force provided by polishing. Critical slurry particle size control allows for the proper surface finish.

3M has the filtration solutions to control particle size in the slurries used in the polishing process to allow wafer manufacturers to supply the industry.

## Filtration Solutions

### 3M™ Betapure™ NT Series Filter Cartridge

- ▶ Superior particle retention with ratings from 0.5 to 70 micron to suit a range of applications.

### 3M™ Betapure™ SKYL Series Filter Cartridge

### 3M™ Betapure™ AU Series Filter Capsule

- ▶ Bi-component fiber technology enables Large Particle Count (LPC) reduction.

### 3M™ Betapure™ PPK Filter Cartridge

## Filtration Solutions

### 3M™ NanoSHIELD™ Hollow Fiber Series Filter Cartridge

- ▶ Provides low operating and differential pressure across the filter to reduce outgassing and micro-bubble formation.

### 3M™ LifeASSURE™ EMC Series Filter Cartridge

- ▶ Excellent downstream cleanliness and no IPA pre-wetting and system flushing required.

### 3M™ Betafine™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction provides high surface area and higher product throughputs for prolonged service life.

### 3M™ LifeASSURE™ MFE Series Filter Capsules

- ▶ Robust PTFE and polypropylene materials provide excellent resistance in aggressive chemicals.

## Wet Cleaning Chemicals

During wet processing, the wafers are dipped, immersed, or sprayed with solutions. As device features continue to shrink, ensuring the purity of acids, bases, and solvents used in the manufacture process will remain critical.

From most acids and bases to alcohols and etchants, 3M has the filter for your chemical application.



## Filtration and Dissolved Gas Control Solutions

### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

### 3M™ LifeASSURE™ EMC Series Filter Cartridge

- ▶ Excellent downstream cleanliness and no IPA pre-wetting and system flushing required.

### 3M™ Betafine™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction provides high surface area and higher product throughputs for prolonged service life.

### 3M™ Liqui-Cel™ SP Series Membrane Contactor

- ▶ Utilizes hollow fiber membrane that is impermeable to chemically compatible liquids.

## Electrolyte Plating

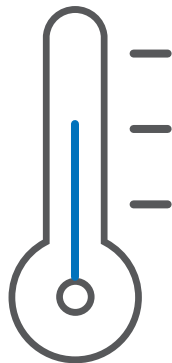
Electroplating solutions require both stringent particle and dissolved gas control to prevent defects and impurities in the deposited metal layer.

3M has both particle and dissolved gas solutions to meet the needs for your electroplating process.

## Process Cooling Water

Process cooling water is circulated to water cooled equipment. Temperature cycling, entrained air, contaminants, and poor water quality can lead to corrosion, scaling and other issues that may inhibit proper cooling and/or decrease service of water-cooled equipment. Proper water treatment allows water-cooled equipment to function optimally during use.

3M has the filtration and gas management solutions to control contaminant and entrained gas in your process cooling water loops to enable a more efficient and stable operation.



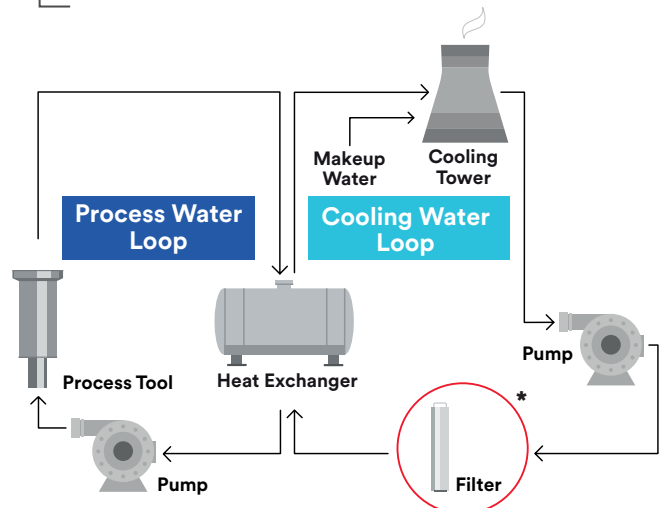
## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.



\* 3M Product Solutions

## Wastewater

Manufacturing wafers requires large amounts of water and chemicals, which invariably generates substantial volumes of wastewater. The many different processing steps create a variety of wastewater contaminants.

3M has filtration solutions designed to help you filter your wastewater to protect the environment and meet increasingly stringent discharge requirements.



## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminate loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ Micro-Klean™ RT Series Filter Cartridge

- ▶ Enhanced contaminant holding capacity for fewer filter change outs.

### 3M™ Betafine™ XL Series Filter Cartridge

- ▶ Features 100% polypropylene construction that provides chemical and thermal compatibility in many demanding applications.

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

## Dissolved Gas Control

3M™ Liqui-Cel™ Membrane Contactors provide efficient dissolved gas control in a compact design. Capable of adding gases to or removing dissolved gases and bubbles from compatible liquid streams, these gas transfer devices utilize hollow fiber membrane technology that help facilities around the world improve operating efficiency, performance and protect product quality.



## Dissolved Gas Control Solutions

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

### 3M™ Liqui-Cel™ SP Series Membrane Contactor

- ▶ Utilizes hollow fiber membrane that is impermeable to chemically compatible liquids.



# Display

Display manufacturing leaves little room for error at every step of the process. Take your display manufacturing process to the next level with the help of reliable and scalable 3M filtration solutions.

## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

### 3M™ LifeASSURE™ EMZ Series Filter Cartridge

- ▶ Charge modified nylon membrane provides mechanical and electrokinetic contaminant reduction.

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

## Applications for Display Manufacturing

### Ultrapure Water

In display manufacturing, any particles in your process water can reduce the quality of your finished product. Ultrapure water (UPW) is needed for rinsing and cleaning glass plates, as well as an ingredient in other processes.

3M has filtration solutions to help ensure the water you use is converted to UPW, so you can have confidence in your process.

## Edge Bevel

Edge Beveling is an important step in your display manufacturing process. Glass edges left untreated after a cut make the glass vulnerable to damage and also leaves sharp edges. Smoothing the edges with abrasives creates particles that need to be removed from the process.

3M has the filtration solutions you need to help remove harmful particles created during the edge beveling process.

### Filtration Solutions

#### 3M™ Betapure™ NT Series Filter Capsule

- ▶ Superior particle retention with ratings from 0.5 to 70 micron to suit a range of applications.

#### 3M™ Betapure™ SKYL Series Filter Cartridge

#### 3M™ Betapure™ PPK Series Filter Capsule

## Lithography/Color Resist Chem

Filtering the chemicals used in your lithography process is crucial for removing contaminant which can cause defects in the finished product.

Meet the needs of high-performance display manufacturing with the help of filtration products from 3M.



### Filtration Solutions

#### 3M™ NanoSHIELD™ Hollow Fiber Series Filter Cartridge

- ▶ Provides low operating and differential pressure across the filter to reduce outgassing and micro-bubble formation.

#### 3M™ LifeASSURE™ EMC Series Filter Cartridge

- ▶ Excellent downstream cleanliness and no IPA pre-wetting and system flushing required.

#### 3M™ Betafine™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction provides high surface area and higher product throughputs for prolonged service life.

#### 3M™ Metal Ion Purifier

- ▶ Effective reduction of metal ions to <50 ppt with higher capacity compared to membrane purifiers.

## Wet Cleaning Chemicals

The filtration you choose for your wet cleaning chemical applications matters. You need to help ensure you're cleaning the layers of your display without adding any new contaminants in the process.

3M has wet cleaning chemical application solutions to meet the level of filtration you need for your display manufacturing process.



## Wastewater

Manufacturing flat panel displays requires large amounts of chemicals, which invariably generates substantial volumes of wastewater. The many different fabrication processes create a variety of wastewater contaminants.

3M has filtration solutions designed to help you filter your wastewater to protect the environment and meet increasingly stringent discharge requirements.

## Dissolved Gas Control

3M™ Liqui-Cel™ Membrane Contactors provide efficient dissolved gas control in a compact design. Capable of adding gases to or removing dissolved gases and bubbles from compatible liquid streams, these gas transfer devices utilize hollow fiber membrane technology that may help facilities around the world improve operating efficiency and performance and protect product quality.

## Filtration Solutions

### 3M™ LifeASSURE™ IMC Series Filter Cartridge

- ▶ Enhanced contaminant reduction capacity with no IPA pre-wetting and system flushing required.

### 3M™ LifeASSURE™ EMC Series Filter Cartridge

- ▶ Excellent downstream cleanliness and no IPA pre-wetting and system flushing required.

### 3M™ Betafine™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction provides high surface area and higher product throughputs for prolonged service life.

### 3M™ LifeASSURE™ MFE Series Filter Cartridge

- ▶ Robust PTFE and polypropylene materials provide excellent resistance in aggressive chemicals.

## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ Micro-Klean™ RT Series Filter Cartridge

- ▶ Enhanced contaminant holding capacity for fewer filter change outs.

### 3M™ Betafine™ XL Series Filter Cartridge

- ▶ Features 100% polypropylene construction that provides chemical and thermal compatibility in many demanding applications.

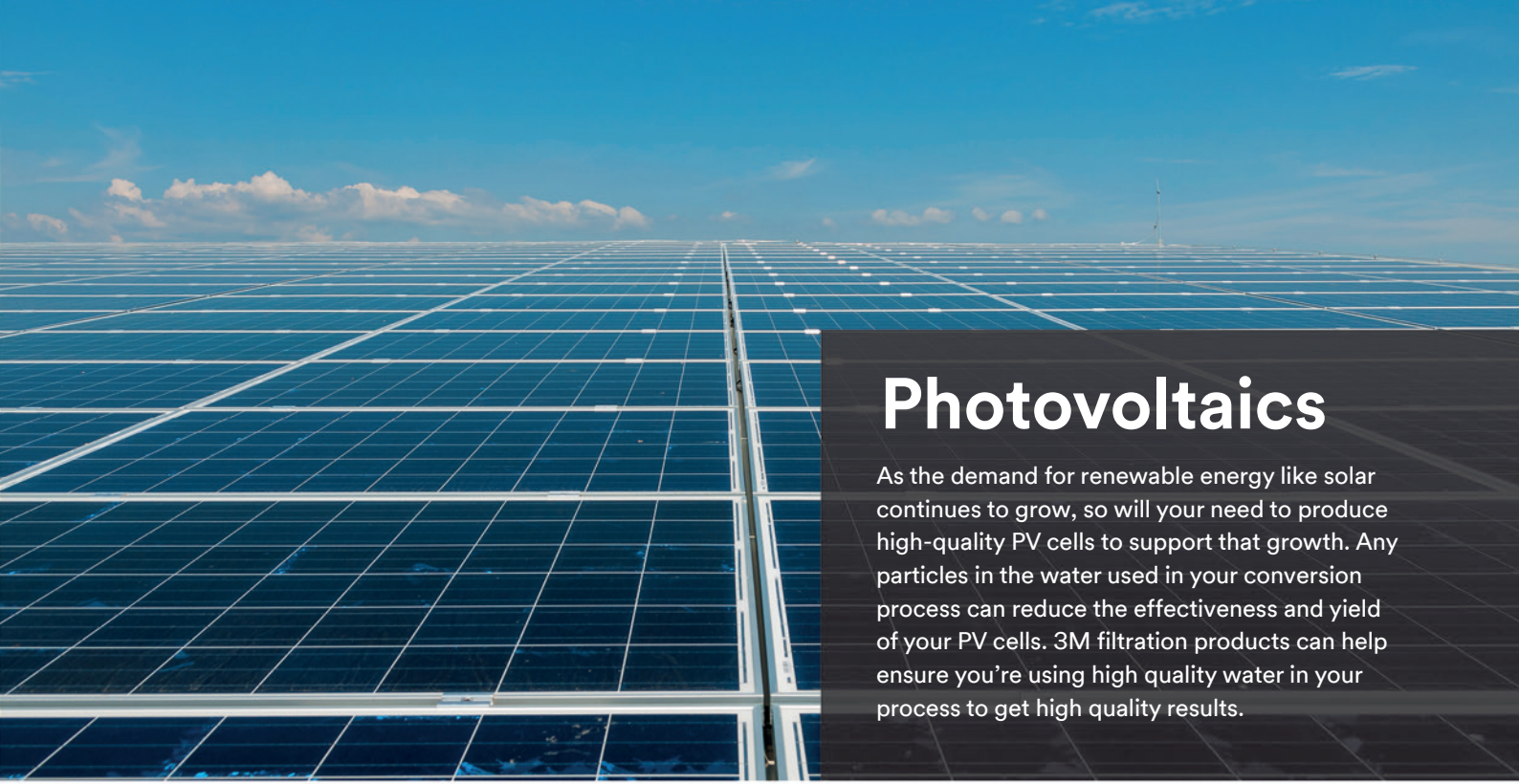
### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

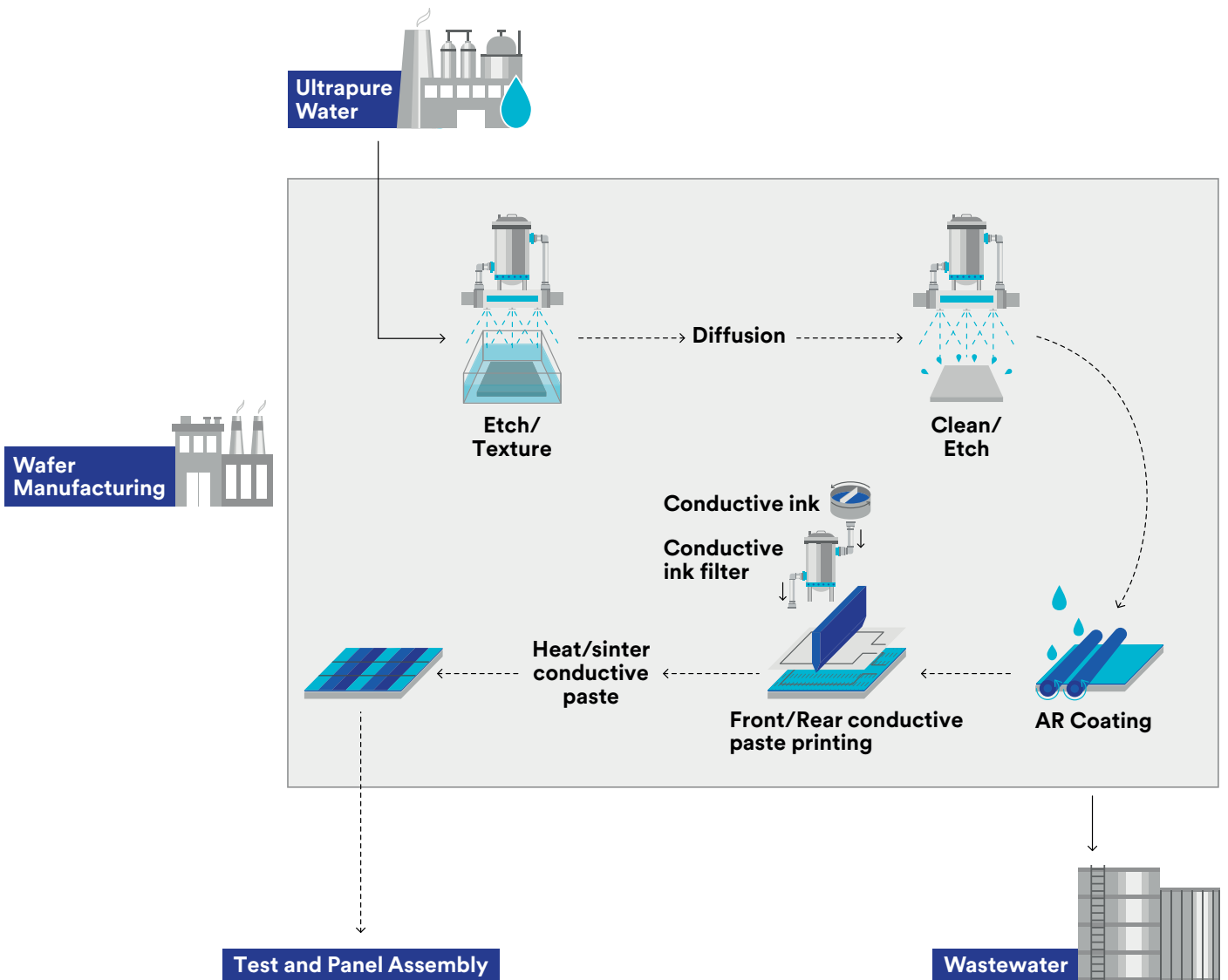




# Photovoltaics

As the demand for renewable energy like solar continues to grow, so will your need to produce high-quality PV cells to support that growth. Any particles in the water used in your conversion process can reduce the effectiveness and yield of your PV cells. 3M filtration products can help ensure you're using high quality water in your process to get high quality results.

## Process Map





## Applications for Photovoltaics

### Ultrapure Water

Ultrapure water (UPW) is needed to remove contaminants when cutting PV cells. Any particles in your process water can reduce the quality of your finished product.

3M has filtration solutions to help ensure the water you use is converted to UPW, so you can have confidence in your process.

### Filtration and Dissolved Gas Control Solutions

#### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

#### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

#### 3M™ LifeASSURE™ EMZ Series Filter Cartridge

- ▶ Charge modified nylon membrane provides mechanical and electrokinetic contaminant reduction.

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

## Edge Bevel

After the cutting process all sharp edges need to be rounded and polished. That's why you need high-quality filtered water to continuously rinse away the generated particles to avoid scratches during the edge bevel process.

3M has solutions to help keep your PV cells free of contaminants that could hinder performance during the edge bevel process.

### Filtration Solutions

#### 3M™ Betapure™ NT Series Filter Cartridge

- ▶ Superior particle retention with ratings from 0.5 to 70 micron to suit a range of applications.

#### 3M™ Betapure™ SKYL Series Filter Cartridge

#### 3M™ Betapure™ PPK Series Filter Capsule

## Process Cooling Water

Certain manufacturing processes require equipment to maintain optimized thermal profiles. Temperature cycling, entrained air, contaminants, and poor water quality can lead to corrosion, scaling and other issues that may inhibit proper cooling and/or decrease service of water-cooled equipment. Proper water treatment allows water cooled equipment to function optimally during use.

3M has the filtration and gas management solutions to help control contaminant and entrained gas in your process cooling water loops to enable a more efficient and stable operation.

### Filtration and Dissolved Gas Control Solutions

#### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.



## Conductive Ink

It's crucial that the conductive ink you use in your process isn't contaminated with oversize particles that can compromise the integrity of the printed circuit of your PV cells.

3M has conductive ink filtration solutions to help meet the needs of your process.



## Filtration Solutions

### 3M™ Betapure™ XL Series Filter Cartridge

- ▶ Features 100% polypropylene construction that provides chemical and thermal compatibility in many demanding applications.

### 3M™ Betapure™ AU Series Filter Capsule

- ▶ Bi-component fiber technology enables Large Particle Count (LPC) reduction.

### 3M™ Betapure™ NT Series Filter Cartridge

- ▶ Superior particle retention with ratings from 0.5 to 70 micron to suit a range of applications.

## Wastewater

Manufacturing PV cells generates large amounts of wastewater that needs to be treated before being recycled or discharged.

3M has filtration solutions designed to address your filtration wastewater needs to either re-use in your process or to meet increasingly stringent discharge requirements.

## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ Micro-Klean™ RT Series Filter Cartridge

- ▶ Enhanced contaminant holding capacity for fewer filter change outs.

### 3M™ Betafine™ XL Series Filter Cartridge

- ▶ Features 100% polypropylene construction that provides chemical and thermal compatibility in many demanding applications.

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

# Hard Disk Drives

For manufacturers of hard disk drives, eliminating damaging contaminants is an essential part of the quality process. 3M filtration products help manufacturers of hard disk drives achieve high levels of process integrity for their critical applications for computer hard disk drives, server farms, data centers, and cloud storage.

## Applications for Hard Disk Drives

### Ultrapure Water

Ultrapure water (UPW) is mainly used to remove defect-causing contaminants from the wafer surface and to rinse or clean wafers after they have been exposed to chemicals during various processes.

3M's filtration and gas transfer membrane products provide the required particle reduction and dissolved gas (O<sub>2</sub> and CO<sub>2</sub>) reduction to help meet the strict requirements of the semiconductor and electronics industry.

### Filtration and Dissolved Gas Control Solutions

#### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

#### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

#### 3M™ LifeASSURE™ EMZ Series Filter Cartridge

- ▶ Charge modified nylon membrane provides mechanical and electrokinetic contaminant reduction.

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

## Chemical Mechanical Polishing

Chemical mechanical polishing (CMP) is a process to level uneven areas by combining a chemical slurry of micro-abrasives with mechanical force provided by polishing.

3M has the CMP filtration solutions to allow hard disk drive manufacturers to help reduce micro scratches and defects and providing more process stability and reliability.

## Plating Chemicals

Your plating solutions require stringent particle control to prevent defects and impurities in the deposited metal surface.

3M has particle control solutions to help remove particulate or contaminants and extend bath life to meet the needs for your electroplating process for process reliability and stability.

### Filtration Solutions

#### 3M™ Betapure™ AU Series Filter Capsule

- ▶ Bi-component fiber technology enables Large Particle Count (LPC) reduction.

#### 3M™ Betapure™ NT Series Filter Cartridge

- ▶ Superior particle retention with ratings from 0.5 to 70 micron to suit a range of applications.

#### 3M™ Betapure™ PPK Series Filter Cartridge

### Filtration Solutions

#### 3M™ LifeASSURE™ EPF Series Filter Cartridge

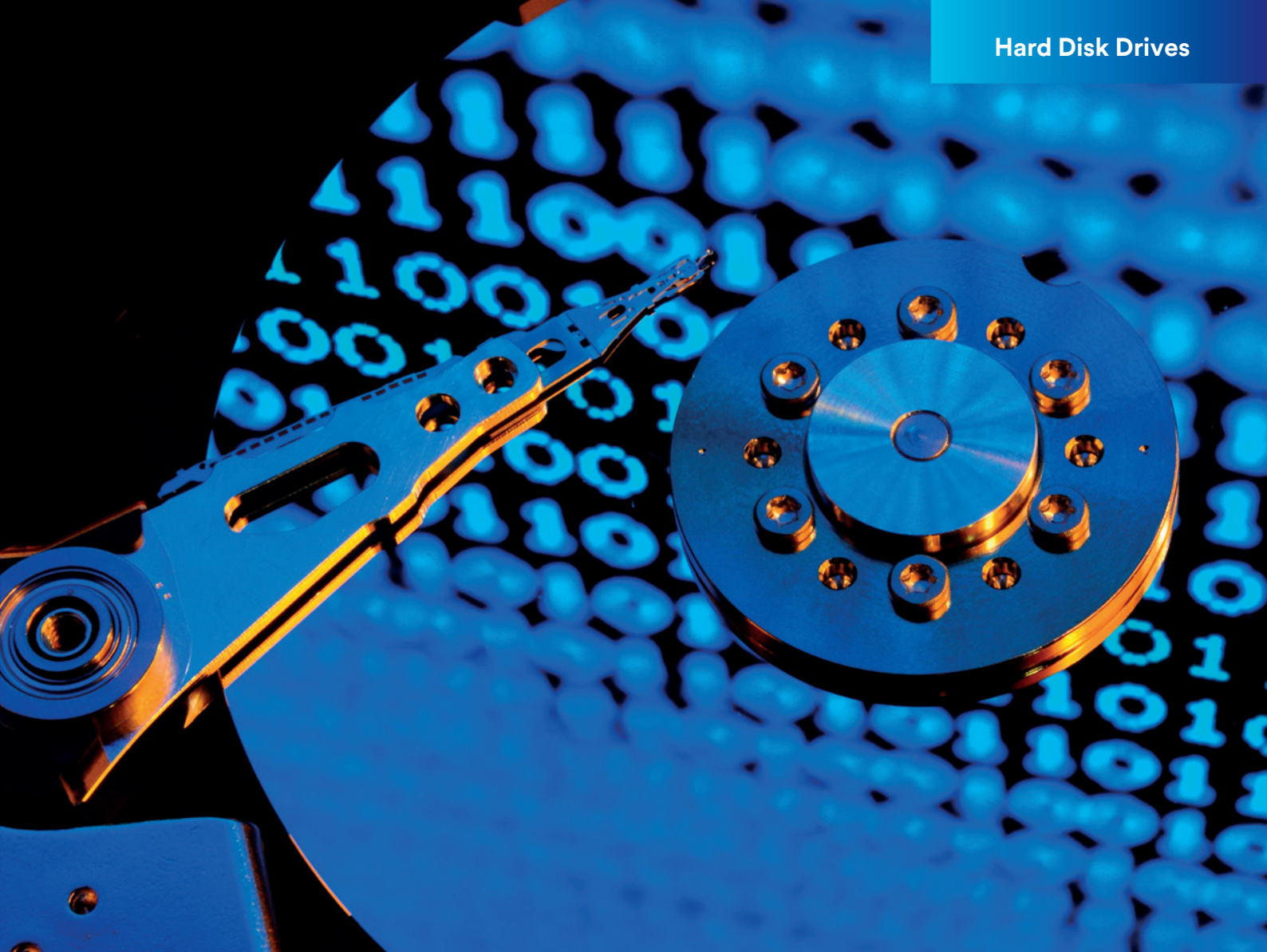
- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

#### 3M™ LifeASSURE™ EMC Series Filter Cartridge

- ▶ Excellent downstream cleanliness and no IPA pre-wetting and system flushing required.

#### 3M™ Betapure™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction provides high surface area and higher product throughputs for prolonged service life.



## Wastewater

Manufacturing of hard disk drives requires large amounts of chemicals, which invariably generates large volumes of wastewater.

3M has particle control solutions to help remove or help reduce particulate/contaminants to extend bath life meeting your desired specifications.



## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ Micro-Klean™ RT Series Filter Cartridge

- ▶ Enhanced contaminant holding capacity for fewer filter change outs.

### 3M™ Betafine™ XL Series Filter Cartridge

- ▶ Features 100% polypropylene construction that provides chemical and thermal compatibility in many demanding applications.

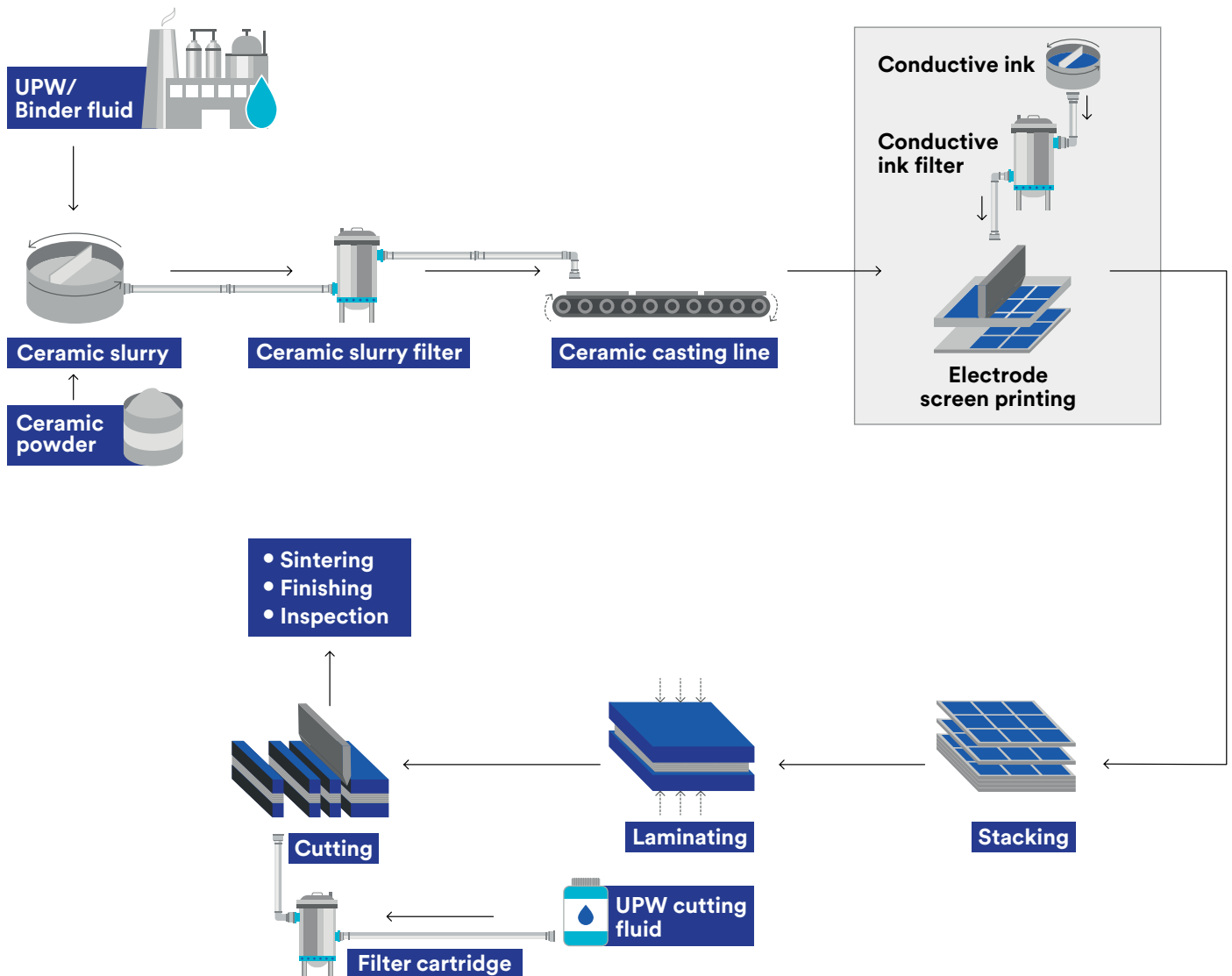
### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

# Ceramic Capacitors

Ceramic capacitors are a critical component in microelectronic devices. The filtration is used to remove unwanted particles during manufacturing of ceramic capacitors otherwise, their performance will be effected. 3M filtration solutions can help ensure the removal of large particles in your ceramic capacitor manufacturing process.

## Process Map





# Applications for Ceramic Capacitors

## Ultrapure Water

Removing contaminants from your source water can help ensure quality finished products. Unwanted contaminants can lead to poor performance and reliability.

3M's filtration solutions for ceramic capacitor applications are designed to help ensure long-lasting high-performance components.



### Filtration and Dissolved Gas Control Solutions

#### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

#### 3M™ LifeASSURE™ EPF Series Filter Cartridge

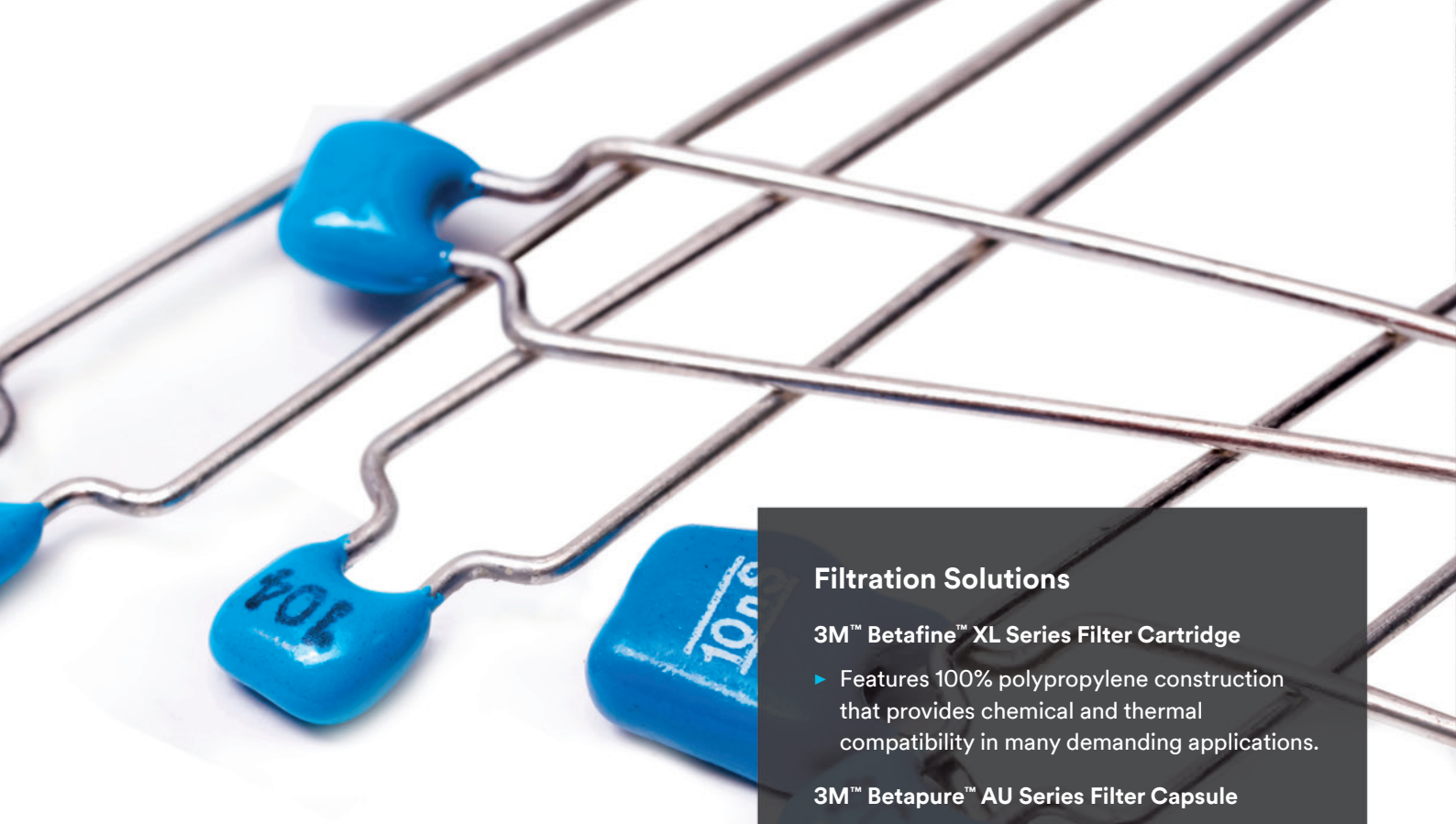
- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

#### 3M™ LifeASSURE™ EMZ Series Filter Cartridge

- ▶ Charge modified nylon membrane provides mechanical and electrokinetic contaminant reduction.

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.



## Conductive Ink

Conductive ink applications require filtration to help ensure uniformity of the conductive metal particles used in the process, allowing the desired particle size through the filter while filtering out the larger ones.

3M has conductive ink filtration solutions to help improve the performance of finished components.

## Wastewater

Almost all manufacturing generates some amount of wastewater that needs to be filtered to remove or neutralize chemicals and metals before it leaves the facility.

3M has filtration solutions designed to help you filter your wastewater to protect the environment and meet increasingly stringent discharge requirements.

## Filtration Solutions

### 3M™ Betafine™ XL Series Filter Cartridge

- ▶ Features 100% polypropylene construction that provides chemical and thermal compatibility in many demanding applications.

### 3M™ Betapure™ AU Series Filter Capsule

- ▶ Bi-component fiber technology enables Large Particle Count (LPC) reduction.

### 3M™ Betapure™ NT Series Filter Cartridge

- ▶ Superior particle retention with ratings from 0.5 to 70 micron to suit a range of applications.

## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ Micro-Klean™ RT Series Filter Cartridge

- ▶ Enhanced contaminant holding capacity for fewer filter change outs.

### 3M™ Betafine™ XL Series Filter Cartridge

- ▶ Features 100% polypropylene construction that provides chemical and thermal compatibility in many demanding applications.

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

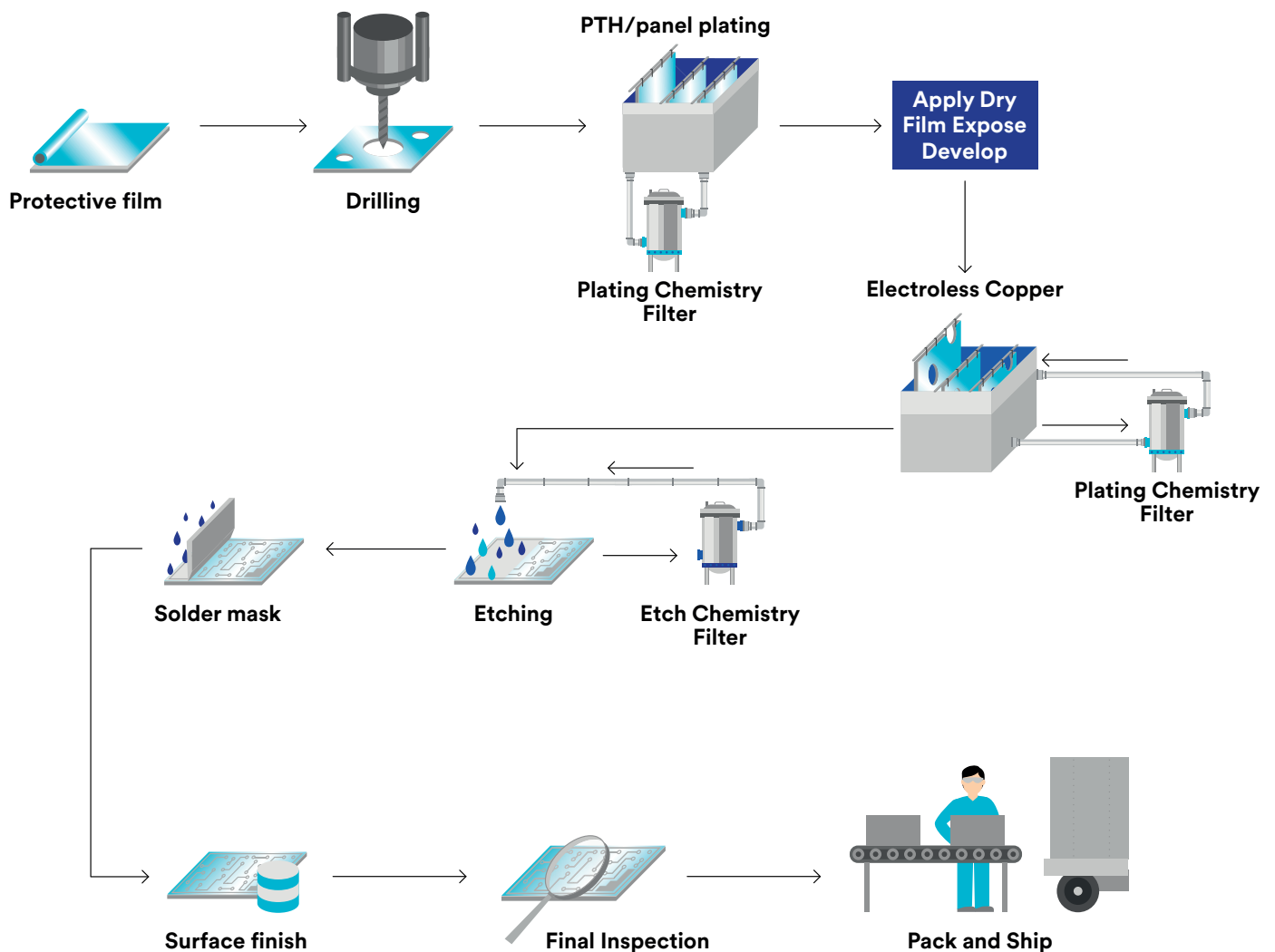
- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

# Printed Wire Boards

Wire board manufacturing involves a lot of pieces, steps and processes that all have to come together with precision to create a reliable finished product. Any contaminant created in the manufacturing process that aren't filtered out can affect the short- and long-term performance of circuit boards.

From film generation to electroless copper plating and screen printing to applying solder masks, 3M filtration solutions can help ensure your wire boards will meet your performance needs.

## Process Map





## Applications for Printed Wire Boards

### UltraPure Water

Ultrapure water (UPW) is mainly used to remove defect-causing contaminants from the surface and to rinse or clean wire boards after they have been exposed to chemicals during various processes.

3M's filtration products provide the particle reduction needed to meet the strict requirements of the electronics industry.

### Filtration and Dissolved Gas Control Solutions

#### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

#### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

#### 3M™ LifeASSURE™ EMZ Series Filter Cartridge

- ▶ Charge modified nylon membrane provides mechanical and electrokinetic contaminant reduction.

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

## Plating Chemicals

It's critical to remove particles from your plating solution to prevent bath contamination. With the right filtration, you can help greatly reduce the amounts of contaminants in your plating solutions.

3M has the filtration solutions you need to help remove contaminants before and during the plating process.

## Wastewater

Your wire board manufacturing process requires large amounts of chemicals, which invariably generates substantial volumes of wastewater. The different fabrication processes create a variety of wastewater contaminants that need to be reduced to meet required levels.

3M has filtration solutions designed to help you filter your wastewater to meet increasingly stringent discharge requirements.

## Filtration Solutions

### 3M™ LifeASSURE™ EPF Series Filter Cartridge

- ▶ Compatible with a wide range of chemicals and the high flow rate increases the rate of recirculation.

### 3M™ LifeASSURE™ EMC Series Filter Cartridge

- ▶ Excellent downstream cleanliness and no IPA pre-wetting and system flushing required.

### 3M™ Betafine™ PEG Series Filter Cartridge

- ▶ Advanced pleat technology construction provides high surface area and higher product throughputs for prolonged service life.

## Filtration and Dissolved Gas Control Solutions

### 3M™ High Flow Series Filter Cartridge

- ▶ High flow and high contaminant loading capacity with 99%+ Particle Removal Efficiency (PRE).

### 3M™ Micro-Klean™ RT Series Filter Cartridge

- ▶ Enhanced contaminant holding capacity for fewer filter change outs.

### 3M™ DF Series Filter Cartridge

- ▶ Provides longer filter life than most conventional bag filters.

### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

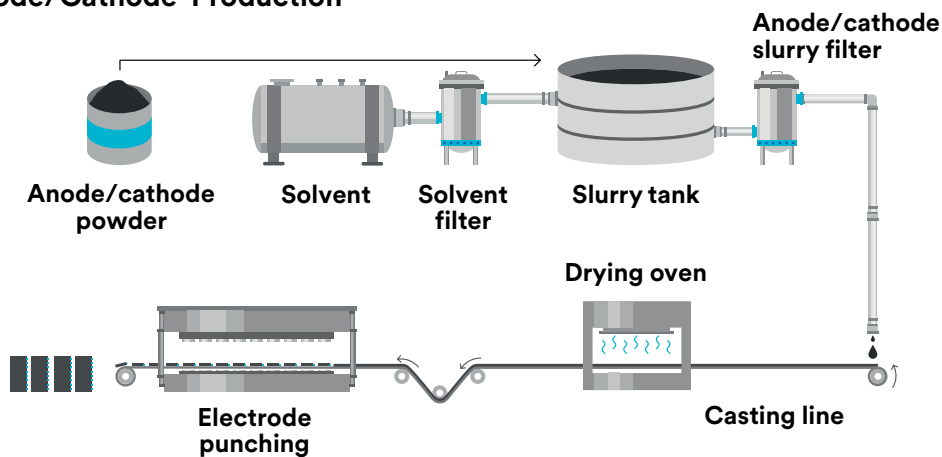
# Lithium-Ion Batteries

The demand for lithium-ion batteries is high and only expected to keep growing, with electronic devices, hybrid and electric vehicles driving demand. Manufacturers with the capabilities to create lighter, longer lasting and more reliable batteries will need better, more efficient contamination control.

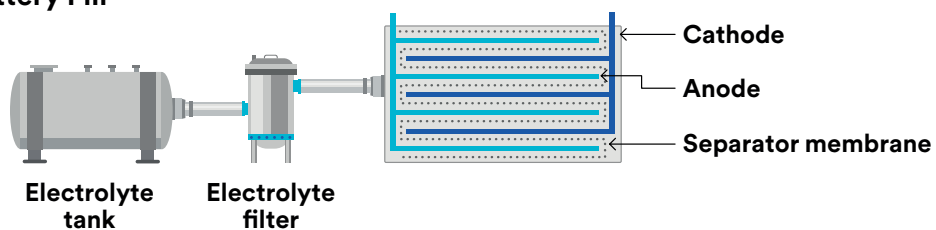
3M filtration solutions can help ensure your lithium-ion battery manufacturing process meets the growing demands of the industry and the high expectations of your customers.

## Process Map

### Anode/Cathode Production



### Battery Fill



# Applications for Lithium-Ion Batteries

## Cathode/Anode Coating

The filtration you choose for your cathode anode coating processes is important because lithium-ion batteries are very sensitive to impurities. Contamination can cause reliability issues and poor battery performance over time.

3M's filtration solutions for cathode/anode coating applications are easy to use and remove, helping to improve productivity and reducing the likelihood of shorts between electrodes.

## Electrolyte Filtration

As with all steps in the manufacturing of lithium-ion batteries, it's crucial to remove particles and impurities that can cause reliability issues and shorten life of batteries.

3M has the electrolyte filtration solutions you need to help remove contaminants and particles to help ensure long-lasting lithium-ion batteries.

### Filtration Solutions

#### 3M™ Betapure™ AU Series Filter Capsule

- ▶ Bi-component fiber technology enables Large Particle Count (LPC) reduction.

#### 3M™ CTG-Klean™ System Filter Pack 1GPJ Series



### Filtration Solutions

#### 3M™ CTG-Klean System

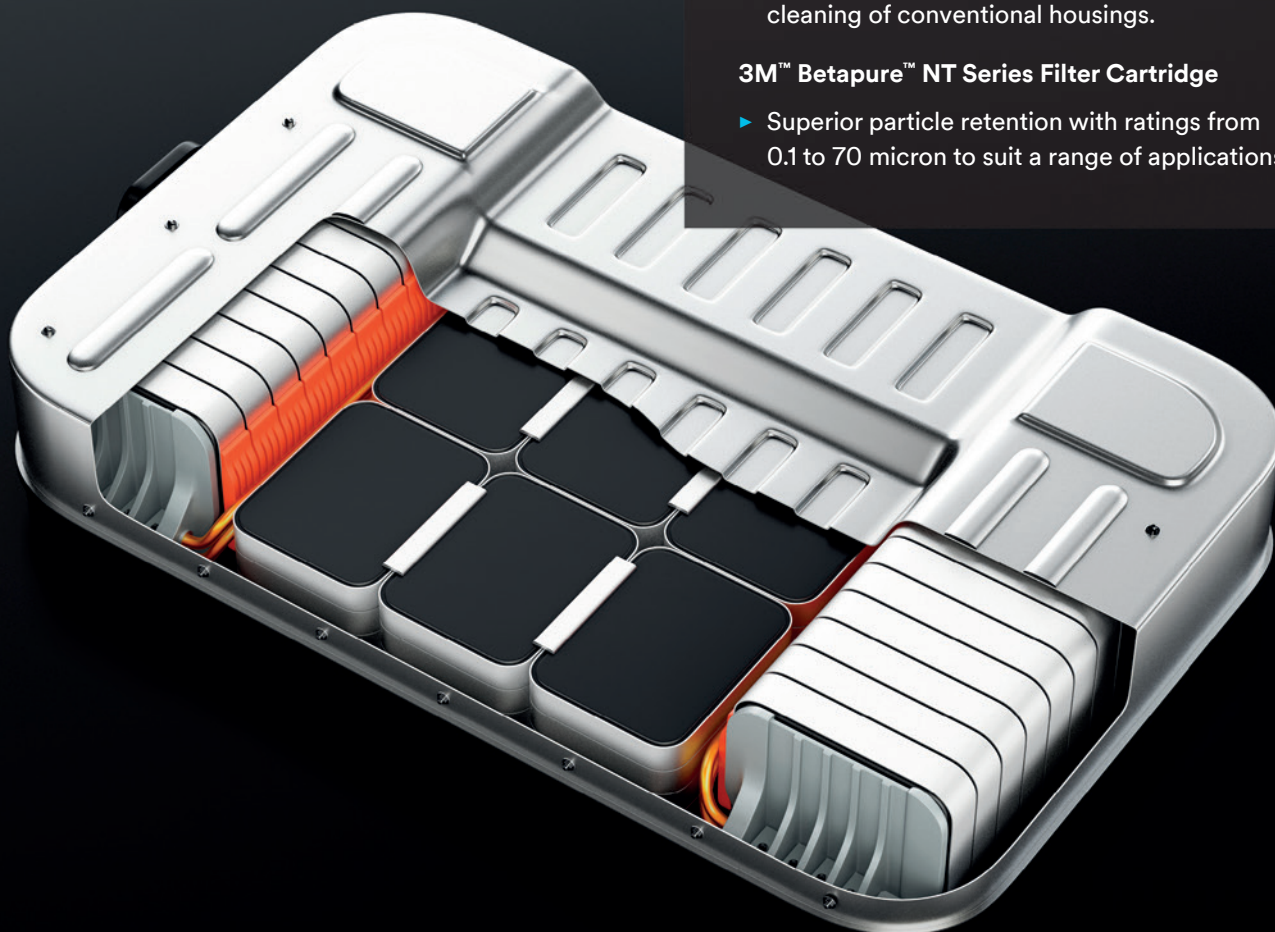
- ▶ Reduces the amount of labor and operator exposure to impurities and cleaning solvents involved with filter change-outs and cleaning of conventional housings.

#### 3M™ CTG-Klean™ System Filter Pack GPJ Series

- ▶ Cartridge pack system design reduces the time and labor involved with filter change-outs and cleaning of conventional housings.

#### 3M™ Betapure™ NT Series Filter Cartridge

- ▶ Superior particle retention with ratings from 0.1 to 70 micron to suit a range of applications.



# Dissolved Gas Control

As semiconductor processing, flat panel display manufacturing and other high-tech industries move to smaller line widths, larger wafer sizes and advancing display technology, dissolved gas control is a critical consideration in ultra-pure water quality.

Because of their efficiency, simplicity and high gas removal performance, 3M™ Liqui-Cel™ Membrane Contactors are a widely used degassing technology in the semiconductor and flat panel display water treatment systems.

Unlike conventional vacuum towers these membrane degasser systems can be expanded. As water volume requirements grow or dissolved gas specifications get lower additional contactors can be added to a system to meet the changing needs.

3M Liqui-Cel Membrane Contactors also enable low concentrations and precision control of the dissolved gases in ultra-pure water and other compatible wet bench processes fluids.





# Applications for Dissolved Gas Control

## O<sub>2</sub> and CO<sub>2</sub> Removal

3M™ Liqui-Cel™ Membrane Contactors remove O<sub>2</sub> from water down to less than 1 ppb and dissolved CO<sub>2</sub> to 0.5 ppm. Low dissolved oxygen levels help protect product yields, while low CO<sub>2</sub> levels may help improve the efficiency of electroionization (EDI) and other ion exchange processes. Membrane contactors are compact, operate in-line and do not require chemicals in operation.

3M Liqui-Cel Membrane Contactors have displaced vacuum towers, forced draft deaerators, and oxygen scavengers around the world for over 20 years. 3M supports your projects with deep technical support and service by working collaboratively to ensure solutions meet requirements and expectations.

## Plating Electrolyte

Electroplating solutions require both stringent particle and dissolved gas control to prevent defects and impurities in the deposited metal layer. 3M has both particle and dissolved gas solutions to help meet the needs for your electroplating process.

### Dissolved Gas Control Solutions

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.

### Dissolved Gas Control Solutions

#### 3M™ Liqui-Cel™ SP Series Membrane Contactor

- ▶ Utilizes hollow fiber membrane that is impermeable to chemically compatible liquids.

## Ammonia Removal and Recovery from Wastewater

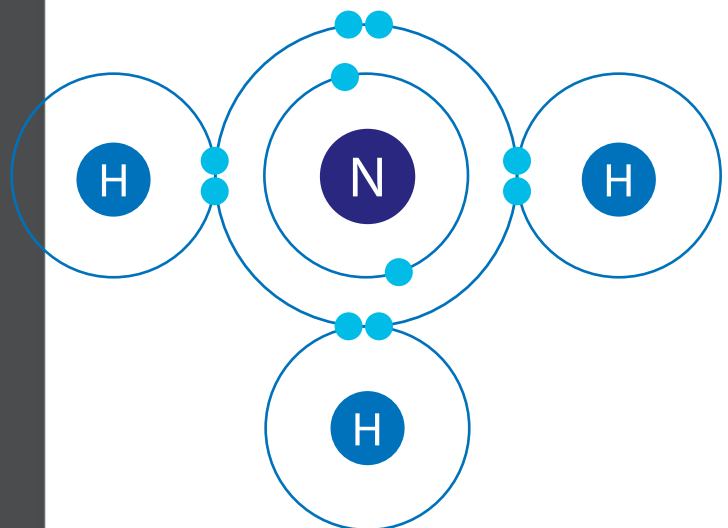
In a process called Transmembrane Chemisorption (TMCS), 3M™ Liqui-Cel™ Membrane Contactors can strip ammonia gas from wastewater streams with a high concentration of ammonia.

The ammonia gas diffuses across the wall of a hollow fiber membrane and is directly absorbed into a reactive acid solution. This makes simultaneous removal and recovery of ammonia possible in a single device.

### Dissolved Gas Control Solutions

#### 3M™ Liqui-Cel™ EXF Series Membrane Contactor

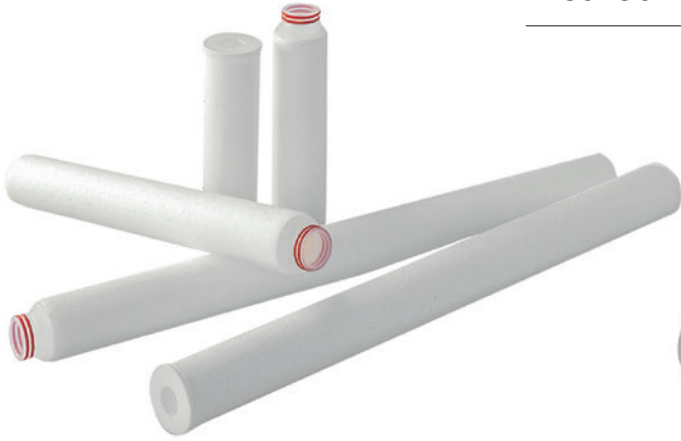
- ▶ Microporous hollow fiber membrane enables rapid and efficient gas transfer performance.



Help ensure quality at every step of your microelectronics manufacturing process with high-quality 3M Filtration and Separation solutions.

**3M™ Betafine™ PEG Series Filters**

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**3M™ Betafine™ XL Series Pleated Filters**

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**3M™ CTG-Klean™ Encapsulated Filter System GPJ Series**

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**3M™ High Flow Series Filter Cartridges**

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**3M™ Betapure™ NT Series Depth Filters**

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**3M™ Metal Ion Purifier**

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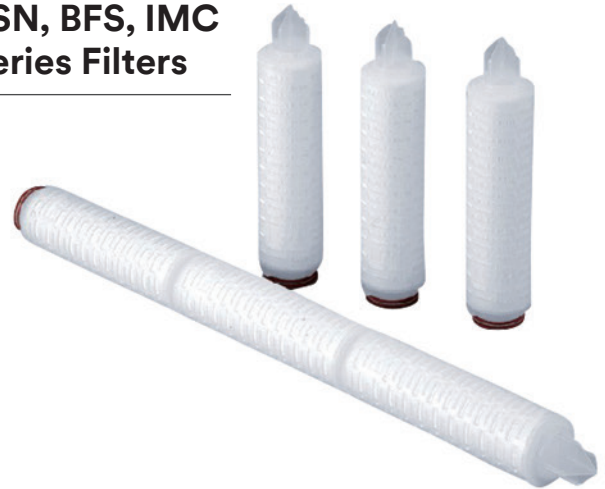
**3M™ LifeASSURE™  
EMZ, EMC, EPF  
Series Filters**



*Advanced Pleat Technology (APT)*



**3M™ LifeASSURE™  
PSN, BFS, IMC  
Series Filters**



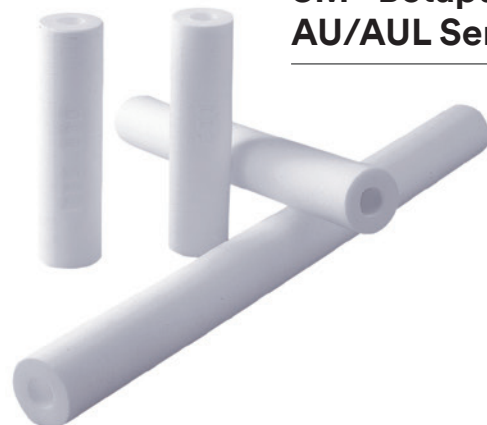
**3M™ Liqui-Cel™  
Membrane Contactors**



**3M™ NanoSHIELD™ Series  
Filter Cartridge and Capsules**



**3M™ Betapure  
AU/AUL Series**



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