# Evaluation of the AOP membrane hybrid process for wastewater reuse in the semiconductor manufacturing processes

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**Abstract:**

Chemical and mechanical polishing processes (CMP) are required to produce semiconductors in the semiconductor manufacturing processes. These processes need large amounts of deionized (DI) water to clean the semiconductor, while it makes lots of wastewater. Generally, feed water of DI water was supplied using water from lakes or rivers near industrial water treatment plants. However, these plants that produce DI water suffer from water shortages due to global climate change. Therefore, wastewater recycling from CMP has recently emerged to conserve water resources. During CMPs operation, it generated specific contaminants in the wastewater, such as tetramethylammonium hydroxide (TMAH), urea, $SiO_2$, fluoride, etc. Specific contaminants should be removed to prevent defects and improve yields for the semiconductor manufacturing process. It was essential to develop advanced wastewater reuse processes for CMP wastewater. This study treated the wastewater by coagulation, glass filter, AOP, ceramic membrane, and RO membrane process. To assess a high efficiency in the AOP, the AOP combined ozone, $H_2O_2$, or ultraviolet-ray. Additionally, the removal of specific contaminants using the advanced oxidation process (AOP) integrated with a membrane process was conducted. Also, the efficiency of the reverse osmosis (RO) membrane according to the composition of the AOP was evaluated. The behavior and removal rate of contaminants in each treatment process were investigated using IC-MS, GC-FID, and ICP-MS. Based on the results, a suitable AOP composition for CMP wastewater reuse was selected by evaluating the permeability and membrane resistances of the ceramic microfiltration or ultrafiltration process and RO process.

**Keywords**: Semiconductor wastewater, Chemical and mechanical polishing (CMP) process, Wastewater reuse, Ceramic membrane, Reverse osmosis.