

Chemical Mechanical Polishing Wastewater Treatment through Membrane Distillation

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Abstract : Chemical Mechanical Polishing (CMP) has developed as a chosen planarization technique in nano-electronics industries for fabrication of the integrated circuits (ICs). These CMP processes release a huge amount of wastewater that contains oxides of nano-particles (silica, alumina, and ceria) and oxalic acid. Since, this wastewater has high solid content (TS), chemical oxygen demand (COD), and turbidity (NTU); therefore, in order to fulfill the environmental regulations, it needs to be treated up to the local and international standards. The present study proposed a unique CMP wastewater treatment method called Membrane Distillation (MD). MD is a non-isothermal membrane separation process, which allows only volatiles, i.e., water vapors to permeate through the membrane and provides 100% contaminants rejection. The performance of the MD technology is analyzed in terms of total organic carbon (TOC), turbidity, TS, COD, and residual oxide concentration in permeate/distilled water while considering different operating conditions (temperature, flow rate, and time). The results present that high-quality permeate has been recovered after removing 99% of the oxide particles and oxalic acid. The distilled water depicts turbidity < 1 NTU, TOC < 3 mg/L, TS < 50 mg/L, and COD < 100 mg/L. These findings clearly show that the MD treated water can be reused further in industrial processes or allowable to discharge in any water body under the stringent environmental regulations.

Keywords : chemical mechanical polishing, environmental regulations, membrane distillation, wastewater treatment

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