

CLAIMS

1. A water polishing system comprising:
 - a connection to a source of ultrapure water (UPW) comprising particles having a diameter less than 30 nm;
 - 5 an ultrafiltration (UF) module having an inlet and permeate outlet;
 - a vibration source operatively coupled to the UF module, the vibration source, when in use, increasing efficiency of a membrane of the UF module to retain the particles having the diameter less than 30 nm from UPW being filtered by applying vibrations to the UF module during filtration of the UPW;
 - 10 a recirculation conduit communicating the permeate outlet with the inlet and forming a recirculation loop;
 - a recirculation pump disposed along the recirculation conduit upstream from the inlet of the UF module and fluidly coupled to the source of UPW;
 - a pressure control valve disposed along the recirculation conduit and directly fluidly
 - 15 coupled to a demand source, the pressure control valve configured to maintain a constant pressure of the permeate at a predetermined value and maintain a constant flux through the UF module, the pressure control valve being controlled based on at least a pressure signal indicative of a pressure of the permeate within the recirculation conduit;
 - a pressure sensor positioned along the recirculation conduit upstream of the pressure
 - 20 control valve and configured to generate the pressure signal indicative of the pressure of the permeate; and
 - a controller operatively coupled to the pressure sensor and configured to control operation of the pressure control valve based on the pressure signal.
- 25 2. The water polishing system of claim 1, further comprising:
 - a UPW make-up conduit fluidly coupled to the source of UPW and the recirculation conduit; and
 - a blending point where the UPW make-up conduit fluidly connects to the recirculation conduit such that the pressure control valve is positioned between the blending point and the

pressure sensor, and the controller is configured to operate the pressure control valve such that the pressure of the permeate is maintained at a predetermined pressure value.

3. The water polishing system of claim 2, wherein the recirculation pump is positioned downstream from the blending point such that a fluid including UPW and permeate is delivered to the recirculation pump at the predetermined pressure value.

4. The water polishing system of claim 3, wherein the recirculation pump is configured to operate at a predetermined constant speed.

5. The water polishing system of claim 3, wherein the UF module further includes a reject outlet for retentate from the UF module and a reject conduit fluidly coupled to the reject outlet.

6. The water polishing system of claim 1, further comprising a holding tank disposed along the recirculation conduit.

7. The water polishing system of claim 1, wherein the vibration source produces vibrations in a frequency range of about 20 Hz to about 1000 Hz.

8. The water polishing system of claim 1, wherein the controller is further operable to adjust a speed of the recirculation pump based on a temperature signal indicative of a temperature of the permeate.

9. The water polishing system of claim 1, wherein the controller is further operable to adjust the pressure control valve based on a temperature signal indicative of a temperature of the permeate.

10. The water polishing system of claim 1, further comprising a supply conduit fluidly coupled to the recirculating conduit and the demand source, the supply conduit positioned downstream from the permeate outlet.

11. The water polishing system of claim 10, wherein the pressure control valve is positioned downstream from the supply conduit.

5 12. The water polishing system of claim 10, wherein the demand source comprises a semiconductor manufacturing tool.