CASE STUDY

Tulsion® Resins for Ultra Pure Water in Solar Cell Manufacturing

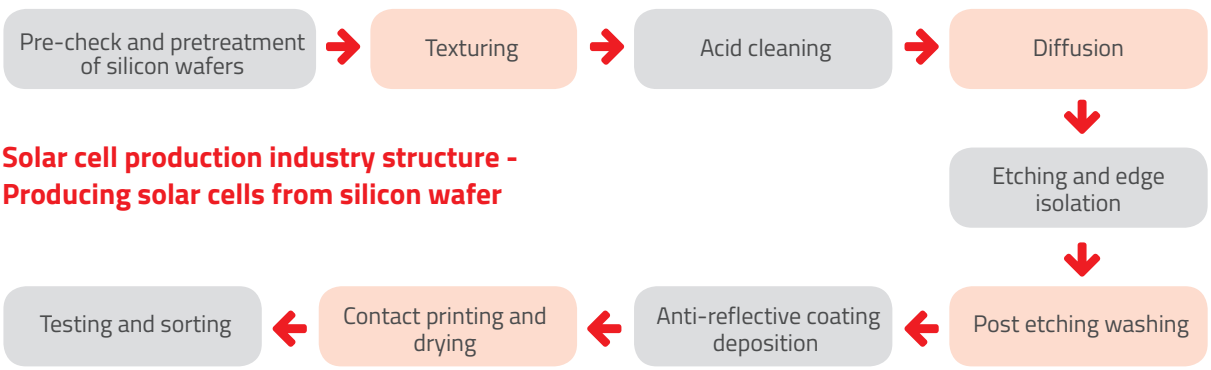
Overview

High purity or Ultra-pure water contains by definition H+ and OH- ions in equilibrium. Ultra-pure water is used in solar photovoltaic device washing. Ultra-pure water in this application has very stringent specification like Resistivity > 14.5 M-ohm, TOC < 20 ppb particle size - 0.1 micron. UPW is also used in semiconductor and pharmauceutical industries where highest purity water is required. It is especially important to remove particulate, ionogenic and organic contaminants in order to meet the highest quality requirements, some ingredients in ultrapure water may only be present in the ppt range (parts per trillion). To achieve this demanding processing goal, adapted treatment steps and a selection of the right materials are required. Ultra-pure water treatment systems vary depending on the source of the water to be processed & where it is used.

Different grades of UPW used in industries

Test parameter	Unit	Semiconductor UPW	Solar cell UPW	Pharma grade
Resistivity	M-ohm	18.1	>14.5	12
TOC	ug/l	1	10	20
Dissolved oxygen	ug/l	10	10	10
Silica	ug/l	1	10	20
Particle size	um	0.1	0.1	1
Viable Bacteria		1/1000 ml	10/1000 ml	10/1000 ml

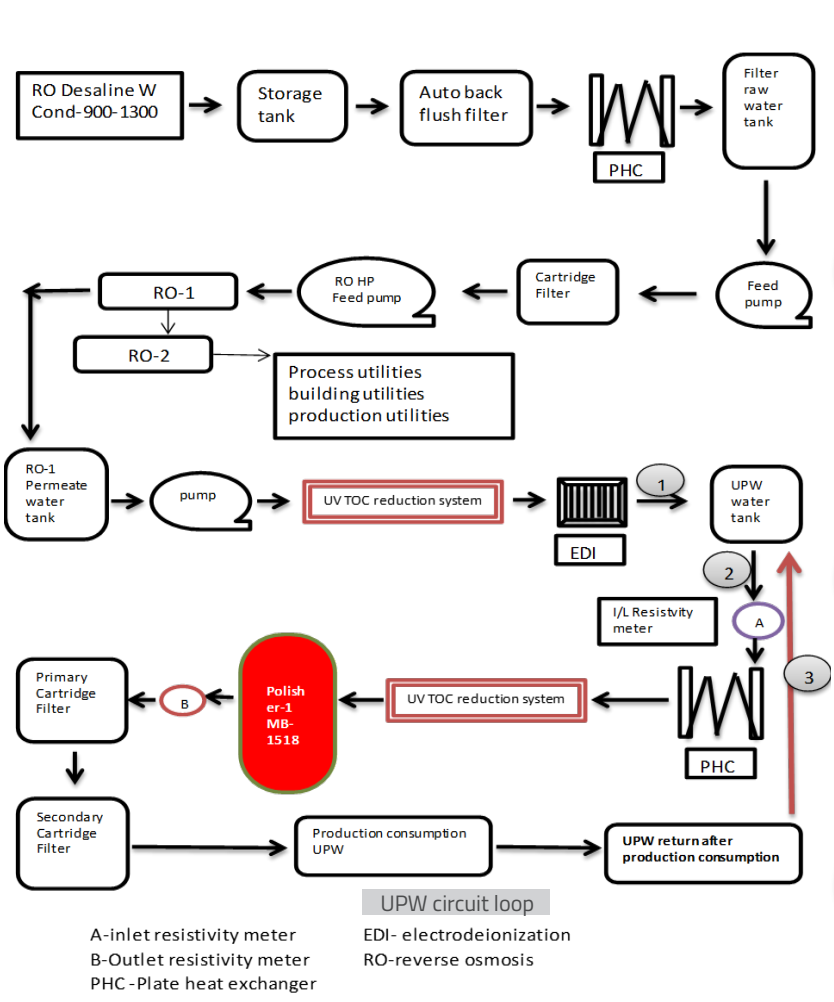
Solar cell production industry structure - Producing solar cells from silicon wafer



Note: UPW is used because the solar device has very small circuit, in which contaminants or deposition can damage circuit lines and device may fail in final test.

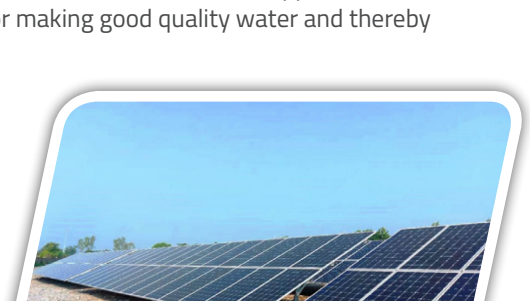
Process

De-saline water from RO is fed to multiple media filters where colloidal partilces is trapped resulting in filtered water. This clean and clear water then enters UPW loop where double stage RO-1 and RO-2 is used to reduce the inlet TDS from 871 to 2 ppm. Reduced TDS water stored in permeate tank is further fed to UV system which helps to reduce the TOC content in water. UV purified water then enters into EDI stacks, where all dissolved ions gets reduced. EDI stacks will give outlet resistivity 12 to 13 M-ohm and this treated water is stored in UPW tank. The temperature of UPW water is maintained by plate heat exchanger and fed to UV system to reduce TOC of water. Finally, UPW water is fed to polisher bed (Tulsion Mixed Bed Resin) with 99 m3/hr flow rate where all remaining ions in UPW water reduce to ppt level and give outlet resistivity near 14.5 to 17 mega-ohms. Polisher plant runs 24*7 for making good quality water and thereby helps to accelerate quality of wafers.



UPW circuit loop

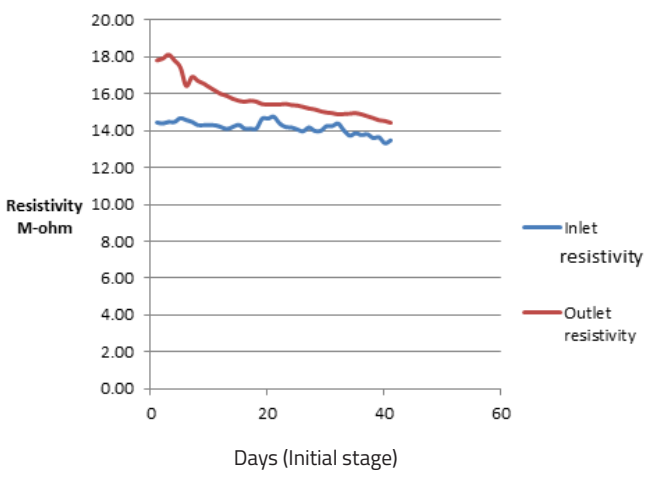
A-inlet resistivity meter
B-Outlet resistivity meter
PHC -Plate heat exchanger
EDI- electrodeionization
RO-reverse osmosis

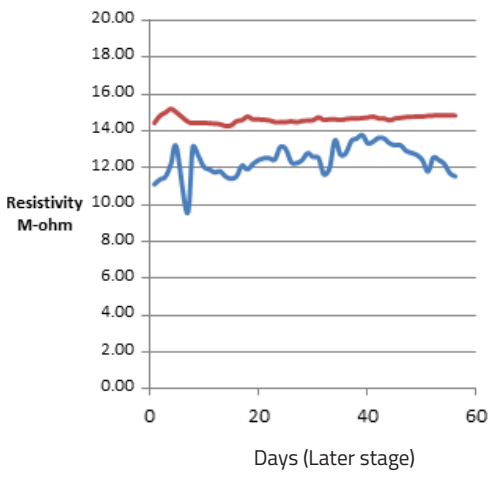


Recommendation

Thermax offers ultra-pure water grade resin to meet the most stringent water purity standards required to produce ultra-pure water for today's solar cell & semiconductor devices. Thermax Tulsion MB-1518, MB-106 UP and MB-1060 UP are used for production of Ultra-pure water.

Thermax supplied Tulsion MB-1518 resin to a leading manufacturer of photovoltaic cell for their polisher bed and the customer was satisfied with the performance as shown in graphs. The first graph shows the resistivity performance in the initial months; while the second graph shows that even reduction of inlet resistivity in subsequent months has given stable outlet resistivity (> 14.5 M-ohm).





Advantages

- Low rinse requirement
- Low TOC and getting resistivity >17 m-ohm
- Higher conversion of ions
- Easier availability