

# Ultra Pure Water

In the semiconductor and display (LCD, OLED) manufacturing process, etching and cleaning using chemicals are indispensable processes. In diluting the chemicals used in this etching / cleaning step and rinsing those chemicals remained, ultrapure water (UPW) is essential. UPW including extremely low impurities is as close to theoretical pure water as possible.

Especially for ultrapure water used in the rinsing process, the following quality is required.

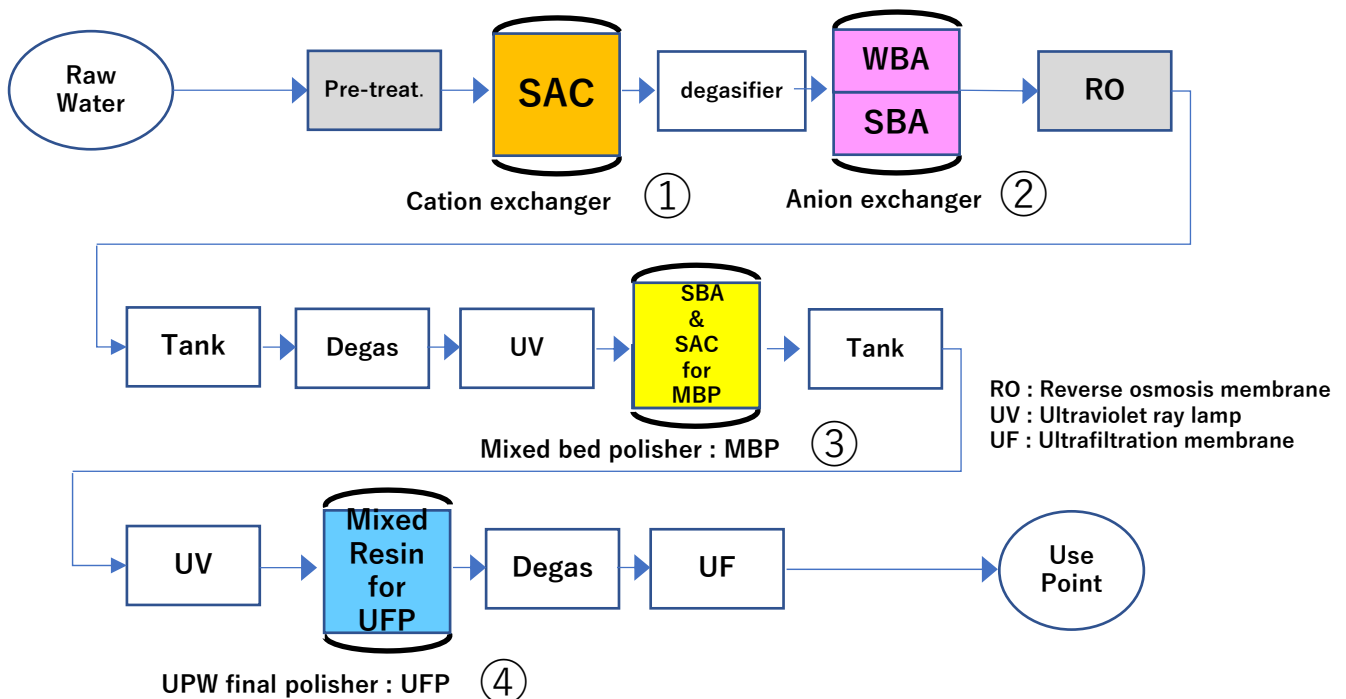
- \* Total organic carbon (TOC) is low.
- \* Electrical conductivity (EC) is as equivalent to that of theoretical pure water as possible
- \* The number of fine particles is extremely small.
- \* Ionic components are extremely low

Therefore, DIAION grades for ultrapure water are under the strict quality control.

Mitsubishi Chemical is able to provide a stable supply of a full lineup of differentiated and extremely clean ion exchange resins. DIAION for ultrapure water is used by leading companies around the world in the semiconductor and display fields.

The ultrapure water production system (for semiconductor and LCD / OLED manufacture) is composed of the primary system consisting of ion exchange, degassing, RO, UV equipment, etc., and the UPW system consisting of UV, ion exchange, degassing, UF equipment, etc.

Ion exchange resins are indispensable for thoroughly removing the ionic components in water, and treatment processes using ion exchange resins are essential for the UPW production process.



- ① SAC: strongly acidic cation exchange resin for cation exchange bed (UBK08, UBK10)
- ② WBA: weakly basic anion exchange resin for anion exchange bed (JA300A, JA310C)
- ② SBA: strongly basic anion exchange resin for anion exchange bed (UBA120, UBA100)
- ③ MBP: strongly basic anion exchange resin for MBP (PA312LTUMB, UBA15MB) (regenerative type)  
strongly acidic cation exchange resin for MBP (UBKN1UMB, UBK10MB) (regenerative type)
- ④ UFP: mixed-bed resin for UFP (SMT200L, USMT100, SMT50) (non-regenerative type)

The figure below shows the desalination performance (resistivity) and the amount of eluted organic matters (TOC: Total Organic Carbon), which are indicators of the quality of UPW at the outlet of the mixed resin for final polisher.

The resistivity rises quickly during the initial rinsing after filling the resin into a column. The initial TOC elution is also suppressed to a low level, and the  $\Delta$  TOC decreases quickly. Furthermore, the leakage of metallic impurities is also reduced to the ppt (ng/L) level.

### Resistivity

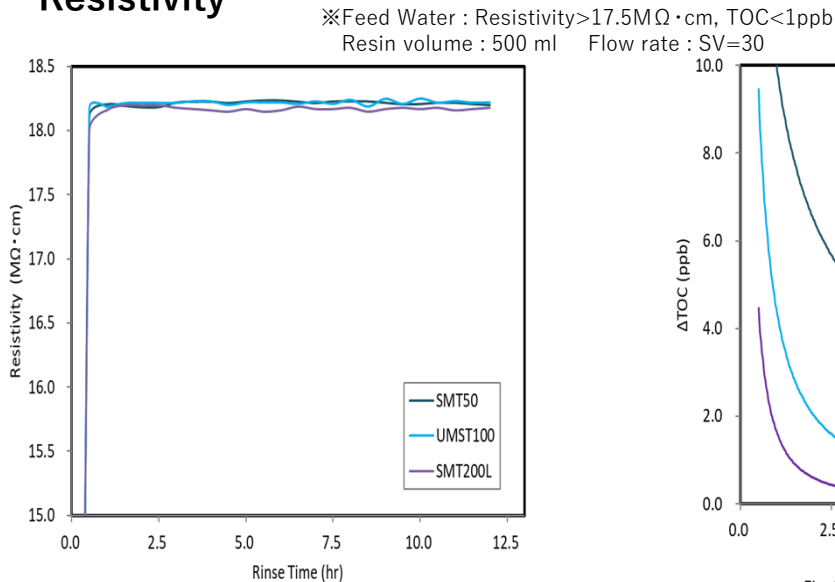


Fig. 1 Rinse Performance for mix bed - Resistivity  
Resin volume 500 mL-R, Flow rate SV 30

### $\Delta$ TOC

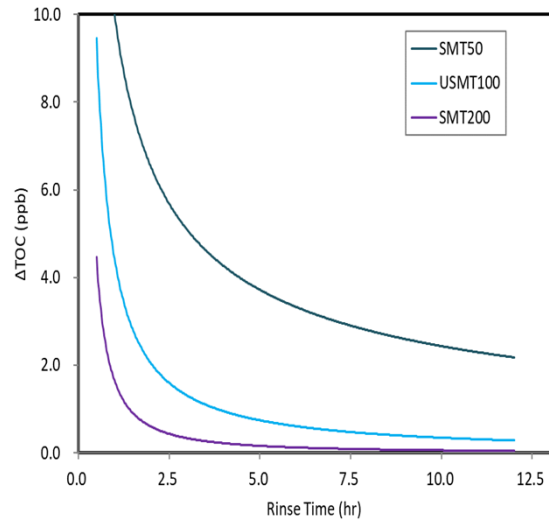


Fig. 2 Rinse Performance for mix bed - delta TOC  
Resin volume 500 mL-R, Flow rate SV 30

As a result of the column rinsing test of SMT200L, the leakage of metallic impurities (Na, Mg, Al, K, Ca, Cr, Fe, Ni, Cu, Zn, Mo, Sn, Pb) were all less than 0.1 ppt.

In particular, the non-regenerative mixed-bed resin SMT200L is extremely excellent for obtaining high-quality UPW.

The characteristics (type, constituent resin, rinsing characteristics, etc.) of the two types of mixed resins for UPW Final Polisher (UFP) and Mixed Bed Polisher (MBP) used in the UPW production system are summarized in the table below.

Puroduct	Application	Regeneration	Type	Matrix	Outlet condition	
					Resistivity	$\Delta$ TOC
SMT200L	UPW	Non-regenerative	Mixed	Gel	$\cong 18.1$ M $\Omega$ ·cm	$\cong 1.0$ ppb
USMT100	Final			Gel(Uniform)	$\cong 18$ M $\Omega$ ·cm	$\cong 2.0$ ppb
SMT50	Polisher			Gel	$\cong 18$ M $\Omega$ ·cm	$\cong 5.0$ ppb
UBK10MB	Mixed Bed Polisher	regenerative	SAC	Gel(Uniform)	>18M $\Omega$ ·cm	<2.0ppb
UBA15MB			SBA	Gel(Uniform)		
UBKN1UMB			SAC	Gel(Uniform)	>18M $\Omega$ ·cm	<2.0ppb
PA312LTUMB			SBA	Porous		

As the control of boron in ultrapure water is becoming severer, the special chelate resin (UPW grade) having B-selective adsorption ability is used for removing boron.