REFERENCE LIST

SEMICONDUCTOR
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Wastewater Treatment and Reclaim Systems

Semiconductor and Electronic Industries

Client	Plant Type	Capacity
Solibro GmbH Thalheim/Germany	**UPW production and wastewater treatment for Solar Cells** Cells production with CIS - technology	Not disclosed
Global Solar Deutschland Berlin/Germany	**UPW production and wastewater treatment for Solar Cells** Cells production with CIS - technology	2 m³/h
Avancis Torgau/Germany	**UPW production and wastewater treatment for Solar Cells** Cells production with CIS - technology	Not disclosed
AMD Dresden/Germany	**Treatment of wastewater from Semiconductor production** HF-treatment Flocculation, precipitation and sedimentation	2 x 25 m³/h
Q-Cells AG Thalheim/Germany	**Wastewater recycling and treatment for silver containing wastewater** Recirculation ion exchanger plant Electro-winning of silver out of the concentrates and final effluent treatment	2 x 8 m³/h 1,8 m³/h
Q-Cells AG Thalheim/Germany	**Treatment of wastewater from electronic industry (solar)** HF-treatment, precipitation, flocculation Sludge dewatering with screw conveyor press Neutralisation	2 x 45 m³/h 140 m³/h
Infineon SC200 Dresden/Germany	**Treatment of wastewater from semiconductor production** Reclaim of TOC consisting wastewater neutralisation and bio-filtration	70 m³/h
Bosch Reutlingen/Germany	**Treatment of wastewater from semiconductor production** Modernisation and extension of the existing HF treatment	40 m³/h
TSMC Fab 14 Tainan/Taiwan	**Reclaim of wastewater from semiconductor production** Reclaim of local scrubber waste water back to the local scrubbers in an internal loop. Reclaim of the backwash water of the multi-media filters and the activated carbon filters of the ultrapure water system.	40 m³/h 50 m³/d
Wacker Freiberg/Sachsen/Germany	**Treatment of wastewater from semiconductor production** Neutralisation Fluoride precipitation Silica precipitation Sludge treatment Treatment of waste water of mechanical wafer production Treatment of spent acid	50 m³/h 42 m³/h 42 m³/h 12 m³/h 4 m³/h 6 m³/h
Philips Shanghai/China	**Treatment of organic wastewater from semiconductor production** Biological Treatment of high COD – containing wastewater, using the patented BIOFIT-H - Technology	m³/h

Client	Plant Type	Capacity
Hamburg/Germany	**Treatment of wastewater from semiconductor production** Separation of fluoride-free and fluoride containing wastewater including additional Drains and lift station	m³/h
	Alteration of the existing waste water plant for fluoridation	
	Treatment of heavy metal containing waste water by ion exchangers	2 m³/h
	Treatment of cyanide containing waste water by ion exchangers	m³/d
Philips Hamburg/Germany	**Treatment of wastewater from semiconductor production** Separation of fluoride-free and fluoride-containing wastewater including additional Drains and lift station	
	Alteration of the existing waste water plant for fluoridation	2 m³/h
	Treatment of heavy metal containing waste water by ion exchangers	3
	Treatment of cyanide containing waste water by ion exchangers	m³/h m³/d
AMD Dresden/Germany	**Treatment of wastewater from semiconductor production** Treatment of HF and H_3PO_4 containing waste water by flocculation/precipitation and sludge dewatering.	m³/h
	Treatment of CMP-waste water by flocculation/precipitation and sludge dewatering	m³/h
	Treatment of Cu containing CMP plating waste water by flocculation/precipitation, followed by ion exchanger	m³/h
	Treatment of heavy metal containing waste water by precipitation and ion exchangers	m³/h
	Neutralisation of various wastewater streams	500 m³/h
ST Microelectronics Catania / Italy	**Treatment and recycling of wastewater from semiconductor production** Treatment of HF-containing rinse water by flocculation/precipitation and sludge dewatering	
	Treatment of HF-concentrates by flocculation/precipitation	
	Treatment of copper-free CMP waste water by flocculation/ precipitation and sludge dewatering	
	Treatment of Ammonia-containing waste water by stripping and absorption to produce a valuable product for reuse.	
	Neutralisation of several kinds of waste water	
	Recycling / Reclaim of low polluted rinse water for secondary users as well as for feeding the UPW plant by activated carbon filters and RO.	
	Collection system for waste chemicals storage and supply system for chemicals for waste water treatment	
TSMC Fab 8 Hsin-Chu, Taiwan	**Recycling of wastewater from semiconductor production** Recycling of CMP waste water back to the UPW plant by Neutralisation, Ultrafiltration, Activated carbon filter and Ion exchange.	25 m³/h

Client	Plant Type	Capacity
AKW Bautzen/Germany	**Treatment of wastewater from semiconductor production** Reverse osmosis	6 m³/h
Infineon Porto/Portugal	**Treatment of wastewater from semiconductor production** Extension of the existing recycling plant for dicing and back grinding waste water Additional capacity of the ultrafiltration of 10 m³/h (total now 30 m³/h)	10 m³/h
Communicant Frankfurt/Oder/Germany	**Treatment of wastewater from semiconductor production** Neutralisation Fluoride precipitation CMP Ultrafiltration Arsenic treatment	m³/h m³/h 14 m³/h 10 m³/d
AKW Bautzen/Germany	**Wastewater from SiC-recycling process** **Wastewater recycling to achieve a wastewater-free process** Ultrafiltration Reverse osmosis	m³/h 12 m³/h
ST Microelectronics Crolles, France	**Treatment of wastewater from semiconductor production** Turnkey delivery incl. two utility buildings *Pre-treatment Fab Crolles 1:* Treatment of copper-free CMP wastewater by flocculation/precipitation and sludge dewatering Treatment of copper-containing CMP wastewater by flocculation/precipitation, sludge dewatering and ion exchange *Pre-treatment Fab Crolles 2:* Treatment of copper-free CMP wastewater by flocculation/precipitation and sludge dewatering Treatment of copper-containing CMP wastewater by flocculation/precipitation, sludge dewatering and ion exchange *Common final treatment in Fab Crolles 2:* Treatment of fluoride- and phosphate-containing wastewater by flocculation/precipitation and sludge dewatering Biological treatment (BIOFIT-F) of wastewaters charged with ammonia, nitrate and organics Continuous neutralisation and final filtration	
Infineon Porto, Portugal	**Extension of the existing recycling plant for dicing and back grinding wastewater** Doubling of capacity of the ultrafiltration and UV-radiation to 10 m³/h	10 m³/h

Client	Plant Type	Capacity
Osram Burgweinting 2001	**Treatment of wastewater from semiconductor production:** Filtration of arsenic-containing grinding/sawing wastewater	
	Last Rinse Recycling	15 m³/h
	Continuous neutralisation	20 m³/h
	Treatment of HF-containing wastewater by precipitation, flocculation and sludge treatment	40 m³/h
	Batch Treatment for scrubber wastewater and arsenic-containing regenerates	5 m³/h 100 m³/d
Infineon Dresden/Germany	**Extension of the existing CMP – Waste Water Reclaim System and Integration of a new Copper – CMP – Waste Water Treatment plant** Moving and Extension of the existing Ultrafiltration plant to a Capacity of 40 m³/h	40 m³/h
	New plant for Treatment of the UF - concentrates	6 m³/d
	New Cu – CMP – Waste Water Treatment plant by - Ultrafiltration - Activated Carbon filters - Selective copper ion exchangers - Treatment line for UF – concentrates and regenerates	2 x 10 m³/h
Infineon Burgweinting/Germany	**Ultrapure water production for and treatment of wastewater from semiconductor production (back end):** Extension of the existing UPW plant	12 m³/h
	Batch treatment for HF-containing wastewater	8 m³/d
	Ultrafiltration for BG wastewater	4 m³/h
AMD Dresden/Germany	**Treatment of wastewater from semiconductor production** Treatment of PB / Sn-containing wastewater with ion exchangers	10 m³/h
	Collection of EDTA-containing wastewater for external discharge	1 m³/d
Texas Instruments Freising/Germany	**Treatment of wastewater from semiconductor production** Neutralisation plant for acidic wastewater	65 m³/h
	CMP wastewater recycling plant with ultrafiltration	6 m³/h
	Concentrate treatment of CMP-UF concentrates	
	Optimisation of an existing HF treatment	
Infineon Dresden/Germany	**Treatment of wastewater from semiconductor production – 300 mm Fab** Treatment of HF-containing wastewater with precipitation / flocculation and sludge treatment	40 m³/h
	Continuous neutralisation	340 m³/h
	Treatment of CMP wastewater by ultrafiltration and concentrate treatment	20 m³/h
	Batch Treatment for arsenic-containing wastewater	10 m³/d
	Recycling plant for first and final rinse by TOC monitoring and activated carbon filters	110 m³/d
	Storage and supply of chemicals and waste chemicals	

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Infineon Burgweinting/Germany	**Ultrapure water production for and treatment of wastewater from semiconductor production (back end):** Softening reverse osmosis, ContiPur (CEDI), loop, polisher mixed bed exchange Continuous neutralisation, lift stations	 12 m³/h 12 m³/h
Siemens Perlach/Germany	**Treatment of wastewater from semiconductor production** Selective exchanger (removal of arsenic)	 15 m³/h
1st Silicon Kuching/Malaysia	**Wastewater treatment plant - Modules 1 and 2:** 1 continuous neutralisation plant (precipitation, flocculation, sedimentation, sludge treatment) for HF-reduction 2 continuous neutralisation plants 1 continuous neutralisation plant (precipitation, flocculation, Sedimentation, sludge treatment) for CMP slurries Chemical supply	 40 m³/h 2x300 m³/h 30 m³/h
Mitsubishi Semiconductor Europe Alsdorf/Germany	**Extension of reclaim plant for first rinse** 2 activated carbon filters, 2 ion exchanger plants	 14 m³/h
AMD Dresden/Germany	**Treatment of wastewater from semiconductor production** Three-line ultrafiltration plant for the treatment of copper-containing CMP wastewater Filtrate post-treatment consisting of activated carbon filter and selective ion exchanger Concentrate treatment consisting of two precipitation lines	 3 x 12 m³/h 3 x 12 m³/h
Infineon Dresden	**Treatment of wastewater from semiconductor production** Extension of an already existing continuous neutralisation plant	 90 m³/h
Siemens Matsushita Deutschlandsberg/Germany	**Treatment of wastewater from semiconductor production** Reconstruction of an already existing wastewater treatment plant Evaporator	 4 m³/h 0.1 m³/h
Imec Leuven/Belgium	**Treatment of wastewater from semiconductor production** Extension of an already existing wastewater treatment system: Treatment line for inorganic wastewater Treatment line for solvent wastewater	 0.5 m³/h 0.5 m/h
Siemens Matsushita Deutschlandsberg/Austria	**Treatment of wastewater resulting from the electronics industry:** Sedimentation Evaporation	 4 m³/h 100 l/h
AMD Dresden//Germany	**Treatment of wastewater resulting from the semiconductor production (CMP):** Ultrafiltration, tanks, pumps, activated carbon filters, selective ion exchange for the removal of copper	 4 m³/h
Fraunhofer Institut Itzehoe/Germany	**Treatment of wastewater resulting from the semiconductor research (CMP):** Ultrafiltration, tanks, pumps	 1 m³/h

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Unibauamt Freiburg/Germany	**Ultrapure water for the semiconductor research:** Pre-filtration, softening, heat exchanger, membrane degasser, reverse osmosis, ContiPur (CEDI), tank, polisher mixed bed, loop Neutralisation Filtration, UV, filtration	5 m³/h
Sunways Konstanz/Germany	**Ultrapure water production and wastewater treatment for the production of solar cells:** Prefiltration, reverse osmosis, ContiPur (CEDI), ultrapure water tank Continuous neutralisation Reclaim	max. 16.4 m³/h max. 16.4 m³/h 11 m³/h
Siemens Microelectronic North Tyneside Tyne and Wear/UK through McAlpine Hochtief JV Tyne and Wear/UK	**Treatment of wastewater from semiconductor production** Extension of an existing wastewater treatment plant by an additional wastewater treatment module, consisting of: Second HF line (continuously operating) incl. sludge treatment Treatment of arsenic-containing wastewater (discontinuously operating) Incl. lift stations, storage tanks and integration into the CIM system	 80 m³/h 5 m³/h
Siemens AG Regensburg/Germany	**Treatment of wastewater from semiconductor production** Extension of an existing wastewater treatment plant by an additional recirculation ion exchanger	15 m³/h
Siemens Semiconductors, Porto/Portugal through Siat Munich/Germany	**Treatment of wastewater resulting from electroplating** Batch treatment Recirculation ion exchange Overall chemical supply **Ultrapure water production plant:** Pre-treatment, reverse osmosis plant, service mixed bed exchange, polisher mixed bed exchanger, UV disinfection, hook-up **Recycling plant:** For dicing and back-grinding, lift stations, microfiltration, concentrate treatment	 5 m³/h 4 m³/h 20 m³/h 10 m³/h
SIMEC GmbH Dresden/Germany	**Membrane treatment process for recycling CMP wastewater:** 2 ultrafiltration plants for inorganic CMP wastewater 1 ultrafiltration and reverse osmosis plant for organic CMP wastewater **Particularities:** Complete integration in the existing water/building concept water recycling about 90%	 2 x 10 m³/h 10 m³/h
IBM Deutschland GmbH Böblingen/Germany	**Treatment of HF-containing rinsing water:** Activated carbon filter, ion exchanger, bio-filter, ozone/UV treatment	10 m³/h

Client	Plant Type	Capacity
Siemens Microelectronic Tyne and Wear/UK through McAlpine-Hochtief JV Tyne and Wear/UK	**Production of ultrapure water for the 8'' wafer production:** Reverse osmosis I, vacuum degasser, UV oxidation, externally regenerated mixed bed exchangers, reverse osmosis II, UV oxidation, polisher mixed bed exchanger, ultrafiltration, hot DI,	120 m³/h
	Treatment of wastewater from semiconductor production 2 batch treatment plants with final filtration, 1 continuous neutralisation plant, 2 continuous neutralisation plants for fluoride-containing wastewater, consisting of baffle plate thickener and filter press 1 microfiltration (dicing) chemical storage and lift stations	5 m³/h 60 m³/h 120 m³/h 5 m³/h
	DI reclaim: Buffering tank for final rinse, lift station	30 m³/h
Chartered Semiconductor Manufacturing Pte. Ltd. Singapore	**Production of ultrapure water for the 16/64 MB production:** Reverse osmosis, vacuum degasser, catalytic oxygen removal, externally regenerated mixed bed exchangers, polisher reverse osmosis plant, UV oxidation, various polisher exchangers, ultrafiltration, hot DI, loop	160 m³/h
	DI reclaim: Measuring tank, buffering tank. ozonisation. UV oxidation, (254nm), activated carbon filter, anion exchanger, cation exchanger	60 m³/h
SIMEC GmbH Dresden/Germany	**Production of ultrapure water for the 16/64 MB production - -Modules 1 and 2:** Each with reverse osmosis, vacuum degasser, catalytic oxygen removal, externally regenerated mixed bed exchanger, polisher reverse osmosis plant, UV oxidation, various polisher exchangers, ultrafiltration, hot DI, loop and equipment connections	2 x 120 m³/h
	Wastewater treatment plant - Modules 1 and 2: 2 continuous neutralisation plants (precipitation, flocculation, sedimentation, sludge treatment) 2 continuous neutralisation plants 2 batch treatment plants (for metal- and arsenic-containing water) incl. sludge treatment 1 microfiltration (dicing + back-grinding) Chemical supply Recirculation ion exchanger for the electroplating shop	220 m³/h
	DI reclaim (> 70 %) - Module 1: Collecting tank, measuring tank, storage tank, neutralisation, bio-polisher, buffering tank, microfiltration, storage tank, activated carbon filter, UV oxidation (254 nm), reverse osmosis plant, permeate tank	2 x 80 m³/h
Shin Etsu Handotai Livingston/UK	**Treatment of wastewater from semiconductor production** Fluoride removal Neutralisation system Nitrification & Denitrification Sand & GAC filtration Bulk chemical storage & dosing for H_2SO_4, NaOH, $Al_2(SO_4)_3$, $Ca(OH)_2$, $NaHSO_3$, IPA & other smaller systems Sludge dewatering Emergency wastewater storage	2 m^3/h 100 m^3/h 120 m^3/h
Siemens AG Regensburg/Germany	**Wastewater treatment plant:** Batch treatment plant with filter press DI reclaim	5 m³/h 35 m³/h

Client	Plant Type	Capacity
Fujitsu Microelectronics Ltd. Newton Aycliffe/UK	**Treatment plant for fluoride-containing wastewater** Addition of selective fluoride removal system to existing plant	60 m^3/h
Texas Instruments Freising/Germany	**Treatment plant for fluoride-containing wastewater** Reverse osmosis plant Batch neutralisation plant	 1.5 m³/h 2 x 6 m³
Fujitsu Microelectronics Ltd. Newton Aycliffe UK	**Treatment of wastewater from semiconductor production** Fluoride removal Neutralisation system	 55 m³/h 110 m³/h
Siemens AG Regensburg/Germany	**Reclaim system for the mega-chip production:** Activated carbon filter, ion exchanger, ozonisation, UV oxidation	 30 m³/h
Technopromimport Moscow/Russia	**Production of ultrapure water for the electronics industry:** Pre-treatment, reverse osmosis plant, UV sterilisation and ultrafine filtration as well as loop, incl. heating facility for supplying the points of use with hot ultrapure water **Wastewater treatment:** Cyanide and chromate detoxification, neutralisation, sedimentation, sludge dehydration	 6 m³/h 6 m³/h
Tesla Piestany Piestany/Slovakia	**Ultrapure water production plant:** H decarbonisation, reverse osmosis plant, vacuum degasser, externally regenerated mixed bed exchanger Polisher mixed bed exchanger, UV sterilisation, ultrafiltration, point-of-use filter with PVDF loop, ozonisation plant, monitoring station with measuring instruments **Wastewater treatment plant:** Continuous neutralisation, fluoride removal, rinsing water recovery and wastewater monitoring station	 50 m³/h 54 m³/h 150 m³/h 60 m³/h

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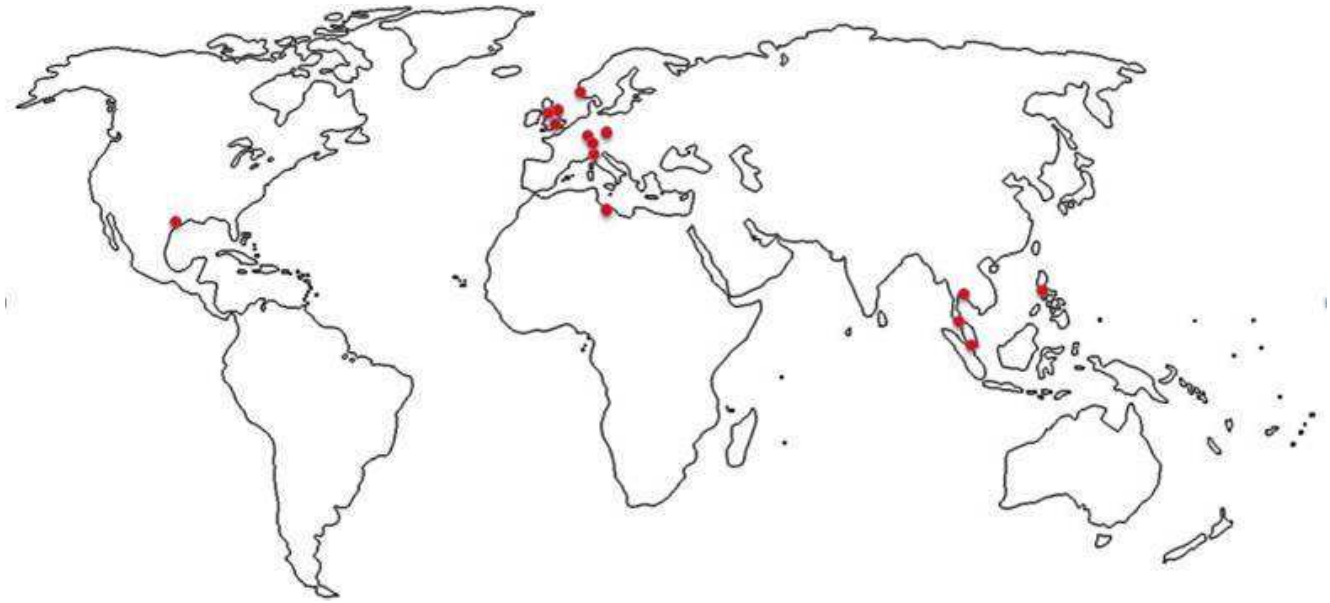

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