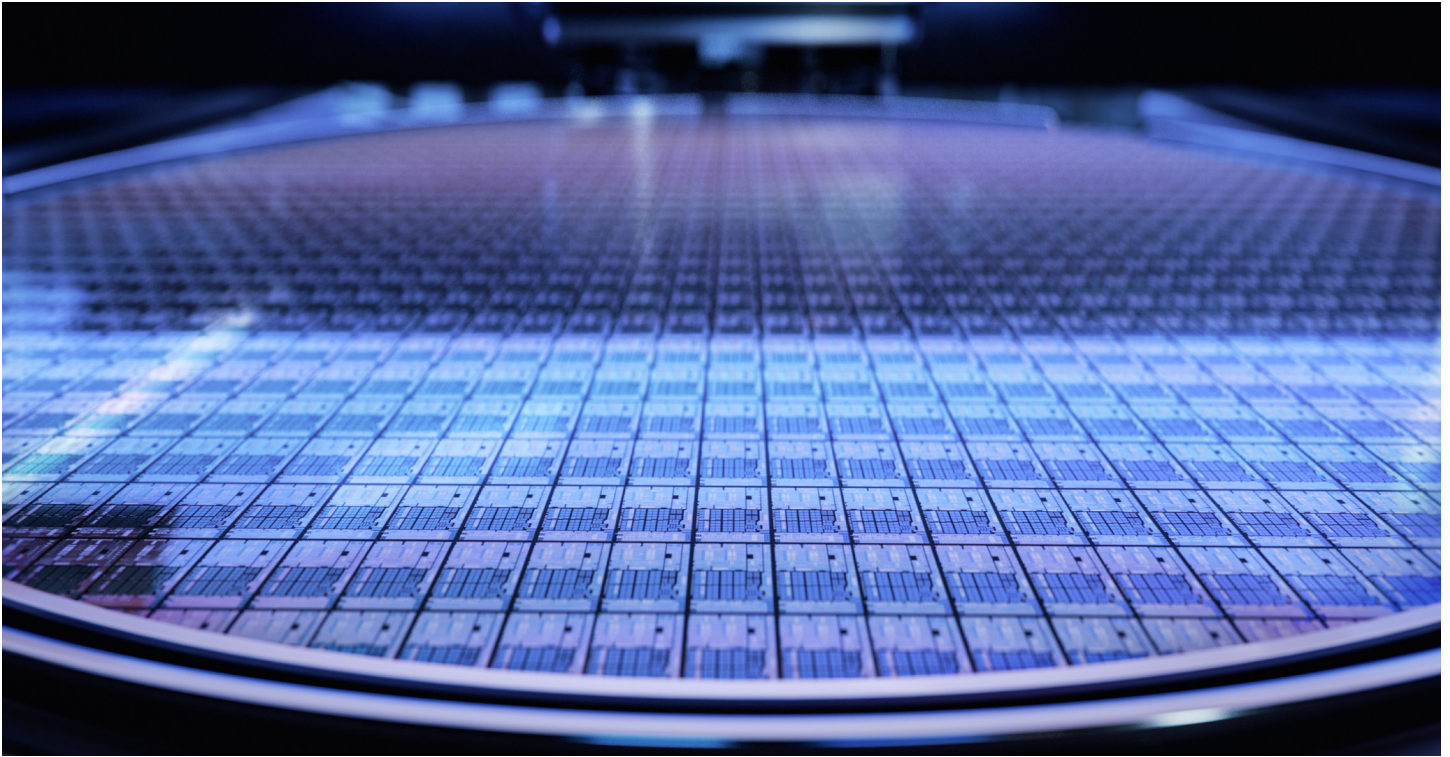


Real-Time Arsenic Data Helps TRUMPF Optimize Ion Exchange System



TRUMPF Photonics, Inc., (TRUMPF), a manufacturer of laser diodes made from Gallium Arsenide substrates (GaAs) wafers, implemented a new wafer thinning process in 2019.

The high-capability process generates a significant amount of hazardous wastewater by volume and was predicted to produce 346 55-gallon drums a week—a severe logistical constraint for TRUMPF, as the facility lacks the capacity to handle such a large volume of waste. As a result, they introduced a practical, cost-effective wafer-thinning wastewater treatment process to support the new high-capability process and meet local regulatory discharge requirements.

Wastewater Treatment Approach

TRUMPF undertook a threefold treatment approach, which included:

1. Removing particles through cartridge filtration
2. Eliminating dissolved ionic arsenic through ion exchange (IEX)
3. Containing, measuring, and reducing trace arsenic particle amounts in wastewater to release compliant wastewater to the city sewer.

To discharge to the local municipal treatment facility, wastewater must contain 500 parts per billion (ppb) or less of arsenic. TRUMPF's wafer thinning process generates untreated influent wastewater with arsenic levels of 42.1 parts per million (ppm) (equivalent to 421,000 ppb). Reliable and continuous measurements of arsenic concentrations in its wastewater was critical for TRUMPF to ensure discharge compliance of its process wastewater.

TRUMPF installed an online arsenic monitor, MetalGuard™ Arsenic, manufactured by AMS, to measure arsenic concentrations in real-time. Installed in 2018, the analyzer supports the entire treatment process by providing data on arsenic levels at various stages. The analyzer measures influent and effluent arsenic levels with sensitivity down to 1 ppb, providing TRUMPF with the necessary data to measure the performance of its IEX system and ensure regulatory compliance.

The Value of Real-Time Arsenic Data to TRUMPF

Implementing the online arsenic monitoring system saved the facility time and money. Using MetalGuard, TRUMPF obtained measurement results in 30 minutes, enabling a better understand of the effects of the different treatment stages on arsenic within the wastewater management system.

As a result, TRUMPF could operate its IEX to treat actual arsenic levels, not dated values produced from laboratory-based analytical methods that took two weeks to produce results. They were able to trend results at multiple stages in the wastewater remediation system to identify patterns and develop learning opportunities. They optimized rinse water reuse and reduced IEX backwash frequencies, increasing media performance and reducing hazardous waste generation. They eliminated the requirement to store treated wastewater until lab results were returned to confirm regulatory compliance. In addition, MetalGuard gave TRUMPF the flexibility to monitor the performance of the wastewater remediation system while the wafer thinning process is running product or in standby.

The wastewater treatment approach undertaken by TRUMPF resulted in process improvements, providing an estimated annual cost savings of more than \$150K with a return on investment of less than one year (Table 1).

Table 1. TRUMPF Cost Analysis – New vs. History Process

Status	Annual Spend or Return		
	Waste Drum Expense	Filters & Ion Tank Exchanges	Total Waste Expenses
New Process	\$17,443	\$15,350	\$29,793*
Historic Process	\$181,810	\$0	\$181,810
Annual Waste Savings			\$152,017

*Note: Includes an estimate for the reclamation of gallium (\$3,000).

With a reliable method to continuously measure the performance of the arsenic remediation system in real-time, TRUMPF transitioned to a close-looped system within months instead of years. The high frequency of accurate and reliable results provided by the online arsenic analyzer gave TRUMPF the confidence to recirculate the treated water back to the source input, reducing water consumption by 90%.

By treating and recirculating the wastewater, the new wafer thinning process achieved a lower overall water consumption than the previous process. This allowed TRUMPF to minimize costs and ensure operation in a greener, more sustainability-focused and environmentally responsible manner.