Application of Sievers* Boron Online UPW Analyzer to Optimize EDI Power Settings and Performance

WATER TECHNOLOGIES

Introduction

Electrodeionization (EDI) is an integral process step used to remove contaminants in many semiconductor ultrapure water (UPW) systems worldwide. EDI utilizes ion exchange (IX) resins, ion-permeable membranes, and high electric potentials to continuously remove ionic contaminants from UPW while also regenerating the resins within the EDI cell. Real-time online effluent monitoring is used to sustain UPW quality, establish appropriate EDI voltage control, and maximize operational efficiencies.

Voltages are applied within the EDI cell to create polar electric fields that draw ions through the exchange resins and across the ion-permeable membranes. Within the EDI cell ion exchange, resins capture ions to produce ionically pure UPW, while the electrical potential continuously regenerates the resins simultaneously. Consequently, EDI systems consume large amounts of electrical power during normal operation.

Real-time monitoring of EDI effluent

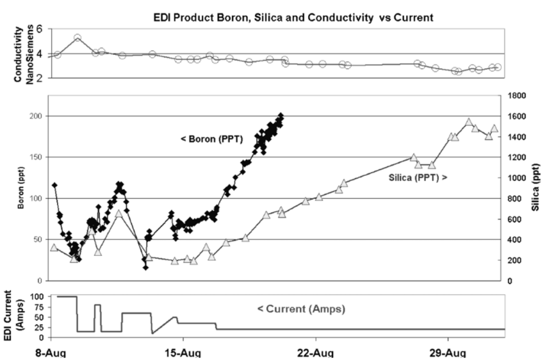
Using precise, online process monitors, EDI performance studies characterized the effect of varying EDI power settings on measured boron, silica and conductivity in EDI effluent in real time[1]. Higher power settings were found to more efficiently remove boron and silica, however, because EDI voltages facilitate the creation of ionic forms of dissolved carbon dioxide, EDI can adversely contribute to higher net conductivity in UPW.

High EDI power settings may contribute to lower UPW quality in addition to increased energy costs, underscoring the importance of determining the optimal power settings for EDI systems to keep UPW quality high and fab operational costs low.

Generally, EDI effluent water quality is a function of feedwater quality, resin efficiency, and EDI power. Because contaminant levels in feedwater will vary and resin efficiencies change over time, EDI power control must be optimally modulated for sustained performance and consistent water quality. To correctly control EDI power settings it is important to monitor EDI effluent contaminants. This will help achieve the greatest efficiency with respect to power consumption and operating costs.

Figure 1 demonstrates a real-world data relationship between EDI power applied and the levels of boron, silica, and conductivity in the effluent.

Figure 1: Relationship between EDI unit and boron, silica, and conductivity[1]



To track critical contaminant levels and overall UPW quality in this study, the semiconductor facility conducting the study used a Sievers Boron Online UPW Analyzer to continuously monitor the dynamic boron levels at the EDI effluent. The data demonstrated a positive correlation between power and water purity, and also showed that it may take a week or more for contaminant levels to stabilize after voltages are changed. Facility engineers were able to establish control of contaminant removal, and minimized operational power consumption using real-time online monitoring to make ongoing EDI power adjustments.

Sievers Boron Ultra Online UPW Analyzer

The Sievers Boron Ultra is a keystone in modern UPW quality management. By offering unparalleled real-time detection capabilities, the analyzer helps manufacturers proactively manage ion exchange processes and prevent ionic contamination events, safeguard downstream processes, and increase product yields. Its advanced technology enables smarter decision-making, ensuring optimal water quality and process efficiency.

[1] "Improving a High-Purity Water System by Advanced Analytical Techniques," Ultrapure Water Journal, accessed via ultrapurewater.com/articles/misc/improving-a-high-purity-water-system-by-advanced-analytical-techniques