



ELECTRO-CHEMICAL DEPOSITION

Enhancing Electro-Chemical Deposition (ECD) Efficiency with Parker Hannifin's Precision Motion Control Solutions

Electrochemical Deposition (ECD) is a pivotal process in the semiconductor manufacturing industry, where it's utilized to deposit layers of conductive metal and insulating dielectrics onto the surface of a wafer. This process is crucial for creating the intricate patterns of transistors and circuits that form the backbone of semiconductor devices. As the initial step in the copper plating process, wafers are immersed in a copper-sulfate-based solution. This delicate procedure lays the foundation for the functionality and reliability of semiconductor devices.

CHALLENGE

A leading Original Equipment Manufacturer (OEM) specializing in ECD tools faced a significant challenge in their wafer dipping process. The precision with which a wafer is introduced into the copper-sulfate solution is critical. Dipping the wafer too quickly or at an incorrect angle can introduce bubbles into the solution, which then become trapped voids in the microscopic features of the wafer. These voids can ruin the wafer by preventing transistors from functioning correctly or conducting electricity as intended. As semiconductor devices become increasingly miniaturized, the demand for an ECD process that ensures a void-free fill and minimal defects has never been higher.

SOLUTION

In response to this challenge, the OEM partnered with Parker, a leader in motion and control technologies. Together, we embarked on a project to refine the wafer dipping process. The collaboration led to the development of an advanced algorithm that optimizes the coating process, ensuring that the solution fills all microscopic features of the wafer without leaving any voids.

Parker's motion controllers, linear actuators, and motors were at the heart of this solution. These components work in unison to control the wafer's introduction into the solution with unparalleled precision. By coordinating the wafer's tip, tilt, spin, and trajectory, Parker's technology ensures a void-free immersion and maximizes the filling of high-aspect-ratio structures on the wafer. This coordination is achieved through a sophisticated control system that communicates with the host controller, ensuring that every axis works together seamlessly.

CUSTOMER VALUE

The partnership between the OEM and Parker led to a significant improvement in the ECD process. By eliminating the occurrence of bubbles during the wafer dipping phase, the solution has paved the way for the production of semiconductor devices with fewer defects, higher reliability, and improved electrical performance. This advancement is crucial in an industry where the demand for smaller, more efficient semiconductor devices continues to grow.

Through this collaboration, Parker has once again demonstrated its commitment to providing innovative solutions that address the complex challenges faced by the semiconductor manufacturing industry. By leveraging its expertise in motion and control technologies, Parker has helped enhance the efficiency and effectiveness of the ECD process, contributing to the advancement of semiconductor technology.



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