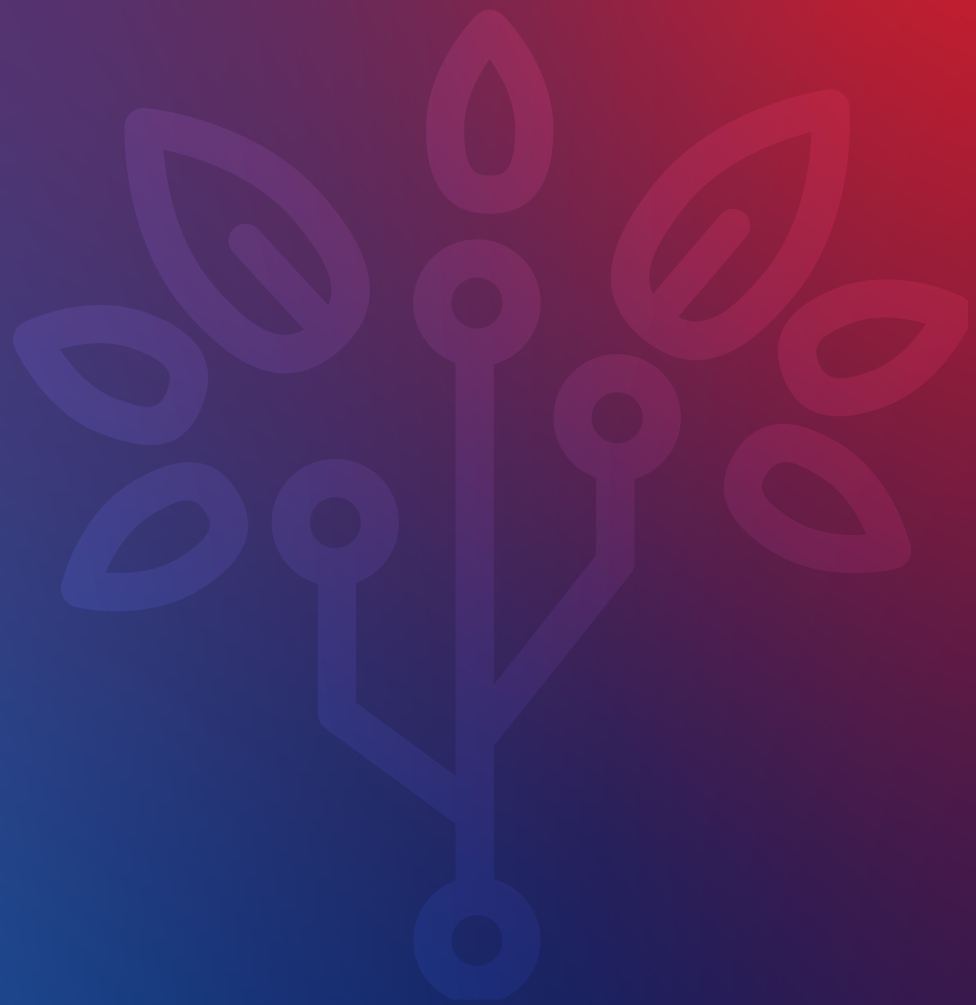
Chapter 1 CONNECTING LAYERS

Contents

Direct Metallization

Adopt a Greener, More Efficient Primary Metallization Process

Discover the transformative benefits of switching to direct metallization in the first chapter in our eBook series.



MacDermid Alpha ELECTRONICS SOLUTIONS

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Foreword

Organizations across the globe are committed to reducing their environmental impact with many pledging to reach net zero by 2050. Industry organizations, such as the Responsible Business Alliance (RBA), have launched initiatives to identify environmental risks and mitigate adverse environmental impacts for their member's value chains. The Responsible Environment Initiative from the RBA focuses on key environmental concerns including decarbonization, chemical management, water stewardship and circular materials. These issues are particularly relevant to the electronics industry, where environmental impact is a growing concern for many electronic component manufacturers. Historically, board fabricators have consumed large amounts of resources, including power, water, and chemicals, and have used hazardous chemicals like formaldehyde as well as metals such as palladium.

In addition, consumers are also demanding to see tangible efforts towards sustainability from the brands they choose. For example, companies such as Apple have stated goals of reaching carbon neutrality across their value chain by 2030*. They are also working to reduce the water impacts of manufacturing their products by partnering with the Alliance for Water Stewardship.

*Apple Environmental Progress Report 2023

Foreword continued

Changing to more sustainable processes is not without risk. With global disruption impacting supply chains, and the time it takes to qualify new materials and processes, many fabricators are looking for ways to become more sustainable while maximizing supply chain stability by getting locally sourced and created chemistries.

The heat is on more than ever. PCB fabricators and their OEM customers are now addressing their environmental, and sustainability goals.

Do the sustainability benefits of alternative processes outweigh the risks associated with change? How can PCB fabricators and OEMs navigate profitability and supply chain issues using more sustainable processes?

Keep reading to find out.

Can PCB Fabrication be Green?

Yes, PCB fabrication can be green. While traditional processes are often energy-intensive, reliant on hazardous chemicals, and require large volumes of water, the industry is increasingly adopting more sustainable alternatives.

Making conductive electrical pathways within a circuit board is an integral part of fabricating PCBs. Traditionally this process, known as primary metallization, has relied on a chemical process called electroless copper plating, which makes the holes conductive for subsequent copper electroplating.

The electroless copper process requires PCBs to be immersed in chemical baths containing hazardous chemicals such as formaldehyde, cyanide and chelating agents, like EDTA. Some of these hazardous materials are not easily removed from solutions and have been found to be unaffected by conventional wastewater treatment.

Traditional electroless copper processing also uses substantial amounts of energy and water. Additionally, electroless copper uses a palladium activator which is a precious metal. Some companies have highlighted the need to reduce reliance on precious metals in their electronic component manufacturing, highlighting the need to eliminate the palladium activator used in the electroless copper process.

There is an alternative that is transforming the way conductive electrical pathways are fabricated within PCBs. Carbon and graphite-based **direct metallization**.

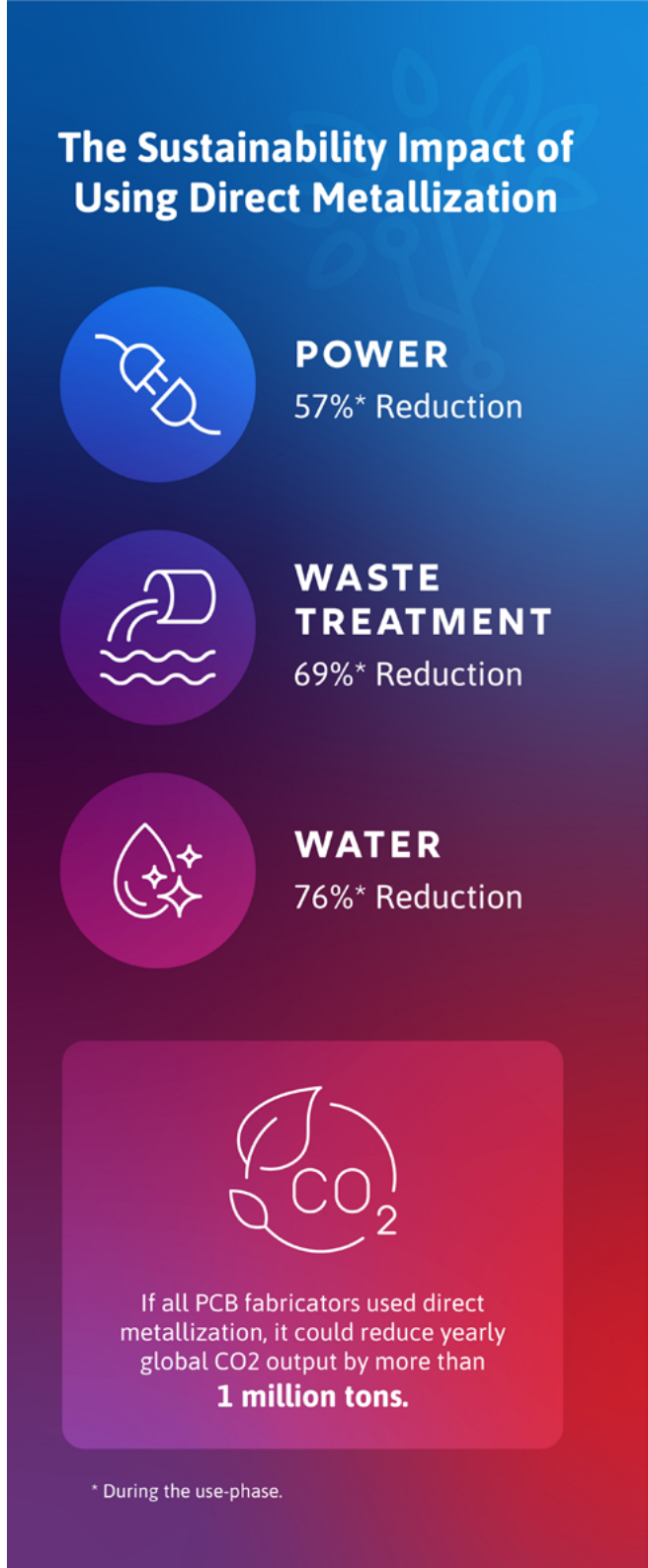
This alternative to electroless copper has fewer process steps and eliminates formaldehyde, palladium, EDTA and other hazardous chemicals. **Direct metallization** also significantly reduces water, energy, and chemical consumption. These factors dramatically reduce the environmental impact of this critical step within the PCB fabrication process.

Tests have shown that **direct metallization** can provide significant performance benefits over electroless copper. The technology enhances reliability through direct copper-to-copper bonding with fewer interfaces and no chance of nano-voiding.

With the potential to improve quality and minimize the EH&S* impacts, **direct metallization** is an alternative technology for creating conductive electronic pathways within printed circuit boards.

Click here to learn more about the sustainability impacts of direct metallization.

*Environment, Health and Safety



How to enhance profitability in PCB Fabrication

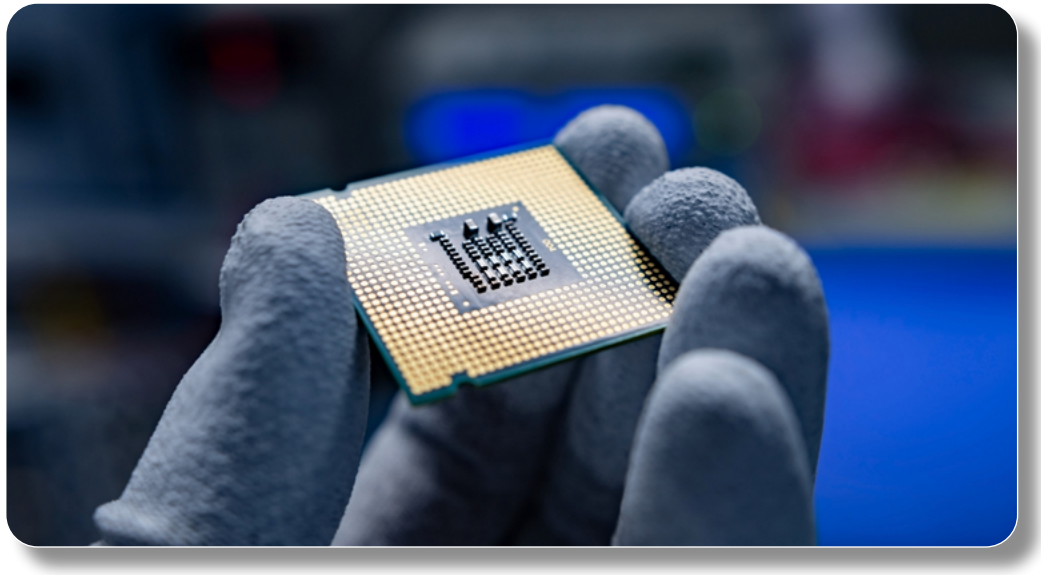
Leveraging change as a catalyst to enhance profitability in the fabrication industry is both a strategic imperative and a promising opportunity.

As the industry trends towards increased functionality and productivity through faster throughput, smaller form factors, and a commitment to sustainability, PCB fabricators and OEMs must adapt to these demands. This includes addressing the adoption of alternative processes and materials that contribute to both sustainability goals and the growing demand for High-Density Interconnects (HDI). As fabricators strive to become the main supplier of choice, the ability to adapt and become more agile helps position them to adopt new technology trends.

By embracing these transitions, fabricators can meet evolving market needs, remain competitive, and realize the rewards of heightened profitability. In the dynamic PCB fabrication sector, embracing change is not just a strategy; it is the key to sustainable success and growth.

Revitalizing profitability hinges on adopting a fresh perspective that drives innovations in fabrication processes and materials.

PCB fabricators and OEMs require a supplier that can provide not just chemistries but solutions to their biggest problems. MacDermid Alpha provides invaluable assistance to facilitate the transition of production lines to cutting-edge technologies such as **direct metallization**, elevate their capabilities to produce higher-density PCB designs and meet the demands of next-generation devices.



Click here to discover how MacDermid Alpha's direct metallization technologies can enable PCB fabricators to meet the industry's evolving needs.

Navigating Disruption in the Supply Chain

From labor costs and lead times to environmental impacts, developing a robust supply chain strategy involves numerous challenges. With the right materials and expertise, manufacturers can navigate these challenges.

Developing a diversified supply chain by migrating PCB production capacity to the growing economies of South East Asia (SEA) is a new challenge that PCB fabricators currently face. Transitioning PCB production to a new facility can feel like a formidable task given the time, labor, and resource-intensive operations that are involved. When moving to new locations it is important to have a chemical supplier that can respond locally and help get new sites running smoothly. Other potential environmental impacts make it increasingly obvious that the 'new normal' will make sustainability and resource conservation a top priority.

There are many areas along the PCB supply chain where there is room for improvement in sustainable manufacturing.

The primary metallization step in PCB manfacturing is one area where significant improvements can be made. While electroless copper has been the process of record for a long time to make holes conductive its time to shift to new processes and adjust to the changing times.

Transitioning PCB production lines from a traditional electroless copper plating process to **direct metallization** creates many advantages that support efficient, cost-effective and environmentally conscious migrations to new production facilities.

Discover how partnering with MacDermid Alpha can ease the transition to direct metallization.

MacDermid Alpha Electronics Solutions at a Glance

MacDermid Alpha Electronics Solutions, a prominent business of Element Solutions Inc, holds a distinguished position as a global leader in the field of fully integrated materials, helping to deliver enhanced performance, reliability, and sustainability to electronic manufacturers worldwide.

Their expertise is segmented as follows:

- **Wafer Level Packaging Solutions:** Revolutionizing wafer fabrication processes for enhanced efficiency and performance.
- **Semiconductor Assembly Solutions:** Driving innovation in semiconductor assembly processes for unparalleled reliability.
- **Circuitry Solutions:** Tailored solutions to meet the dynamic demands of modern circuitry.
- **Circuit Board Assembly Solutions:** Elevating circuit board assembly processes for optimal performance.
- **Film & Smart Surface Solutions:** Transforming electronics with cutting-edge materials and technologies for enhanced functionality and reliability.

With a legacy spanning over a century of innovation, MacDermid Alpha has garnered the trust of manufacturers around the globe and is actively shaping industries such as automotive, consumer electronics, mobile devices, telecom, data storage, and infrastructure. The business is uniquely positioned to deliver high-quality solutions and technical services to comprehensively cover the entire electronics supply chain.

For those seeking to power their path to success in the electronics industry, MacDermid Alpha Electronics Solutions offers exceptional business opportunities. Join them on their journey of innovation and excellence.

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