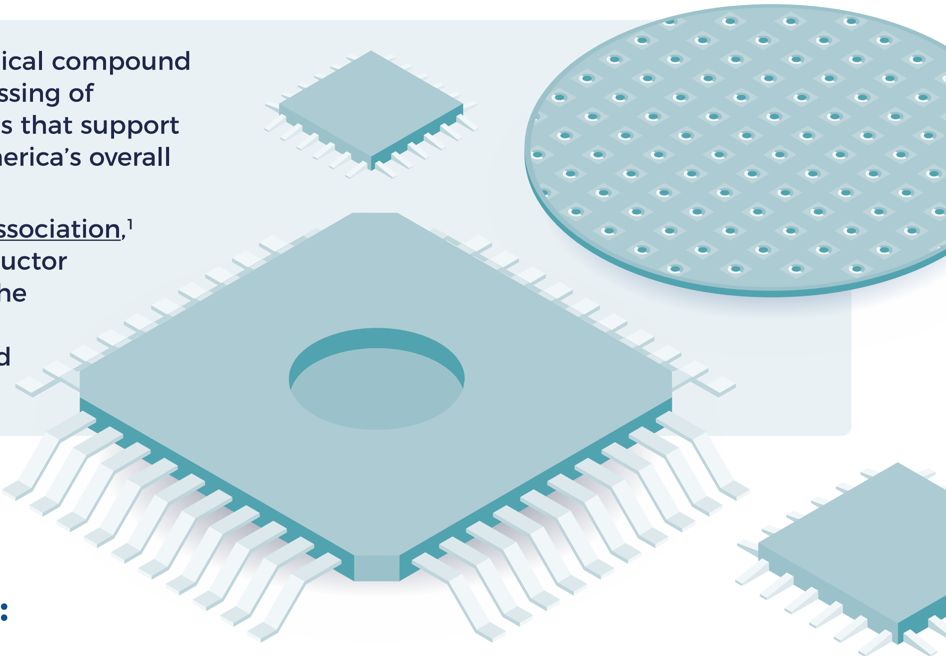
FORMALDEHYDE
SEMICONDUCTORS

Formaldehyde is a naturally occurring chemical compound that is vital to the manufacturing and processing of semiconductors found in modern electronics that support virtually all aspects of our daily lives and America's overall economy.

According to the Semiconductor Industry Association,[1] the U.S. is the global leader in the semiconductor sector. Our continued leadership is vital to the success of industries including IT, telecommunications, healthcare, energy, and national defense.



Key formaldehyde applications in semiconductor manufacturing and processing:

1. **Surface Coatings:** Formaldehyde is used in the surface coating of metal-semiconductor products.[2]
2. **Photoresist Stripping:** Formaldehyde is used to strip photoresist, a light-sensitive material used to create semiconductor wafer patterns, from final products.
3. **Mold/Surface Cleaning:** Formaldehyde helps remove organic and inorganic contaminants from the wafer's surface, ensuring that the semiconductor's performance is not compromised.
4. **Anti-Corrosion:** Formaldehyde can be used to protect semiconductor devices from environmental factors and prevent corrosion.[3]
5. **Energy Conversion:** Formaldehyde-based resins can act as efficient, metal-free semiconductor photocatalysts for solar-to-hydrogen peroxide energy conversion.[4]
6. **Adhesives and Thermal Management:** Formaldehyde-based adhesives help bond semiconductor chips to their packages and provide thermal management.[5]
7. **Wafer Metallization:** Formaldehyde may be contained in electroless copper plating used to connect a finished chip to a substrate, circuit board, or another semiconductor chip.

The use of formaldehyde in semiconductor plating and lithography resins is considered an industry standard, and it is widely used by manufacturers around the globe. It is important to note that formaldehyde does not remain in finished semiconductor products in the U.S.

[1] Semiconductor Industry Association. *Formaldehyde Scoping Comments June 2020*, www.semiconductors.org/wp-content/uploads/2020/06/Formaldehyde-scoping-comments-june-2020.pdf.

[2] EPA Office of Chemical Safety and Pollution Prevention. *Draft Scope of the Risk Evaluation for Formaldehyde CASRN 50-00-0 - US EPA*, www.epa.gov/sites/default/files/2020-04/documents/casrn-50-00-0_formaldehyde_draft_scope_4_15_2020_1.pdf.

[3] Lee, In-yeal, et al. "Poly-4-vinylphenol and poly(melamine-co-formaldehyde)-based graphene passivation method for flexible, wearable and Transparent Electronics." *Nanoscale*, vol. 6, no. 7, 2014, p. 3830, https://doi.org/10.1039/c3nr06517k.

[4] Shiraishi, Yasuhiro, et al. "Resorcinol–formaldehyde resins as metal-free semiconductor photocatalysts for solar-to-hydrogen peroxide energy conversion." *Nature Materials*, vol. 18, no. 9, 2019, pp. 985–993, https://doi.org/10.1038/s41563-019-0398-0.

[5] Tsurumi, Naoaki, et al. "Elucidation of adhesive interaction between the epoxy molding compound and CU lead frames." *ACS Omega*, vol. 6, no. 49, 2 Dec. 2021. 34173-34184, https://doi.org/10.1021/acsomega.1c05914.s001.