

APPLICATIONS OVERVIEW

Dimethylamine Borane (DMAB)

Electroless plating of nickel-boron alloys

Used as a reducing agent in electroless nickel (EN) plating baths for co-deposition of nickel-boron onto a variety of substrates. Nickel-boron (NiB) combines extreme hardness, corrosion resistance, ductility and lower coefficient of friction. As hexavalent chrome has faced regulatory challenges, NiB has emerged as a high-performance alternative.

Considerations for DMAB-based EN plating baths can include issues such as:

- Deposition rate of NiB is a function of DMAB concentration, up to a limit of about 0.06M.¹
- Temperature response is similar to other catalytic nickel processes as long as kept below the onset temperature for DMAB hydrolysis.
- pH for DMAB plating baths is preferably in the 6-7 range.¹
- Boron in final product alloy can range from 0.2-4%, with 1-1.5% being a common target.
- Higher % boron has been reported via the use of zinconyl ions.
- As many as 65 bath turnovers have been reported as a result of soluble byproducts of DMAB reducing agent.
- Techniques & formulations for hypophosphite baths are typically applicable to DMAB also.
- Selection of stabilizers should take into account potential effect on the tensile stress of the product alloy and on boron deposition.

DMAB is also well suited for the electroless deposition of cobalt-boron as well as precious metals including gold and palladium. In addition, Djokic, Rebelli, Diao, and others have reported the use of electroless deposition using DMAB and other reducing agents for the preparation and tuning of bimetallic catalysts like Au/Pd, Pt/Co, Cu/Pd, and Pt/Ru.

¹ Mallory, Glenn O & Hajdu, Juan B & American Electroplaters and Surface Finishers Society (1990). *Electroless Plating: Fundamentals and Applications*.



Sodium borohydride (NaBH₄), also available from Boron Specialties, is also used plate NiB. NaBH₄ costs less than DMAB and can achieve as much as 5% boron in the final product alloy, but baths must be run in the pH 12-14 range to avoid formation of nickel boride.

Organic Synthesis

DMAB is a mild reducing agent. Reactivity with organic functionalities:

Substrate	DMAB in H ₂ O	DMAB in THF
acid chloride	~	~
acid salt	-	~
aldehyde	+	+
amide		-
carboxylic acid	~	~
epoxide	+	-
ester	-	-
imine		+
ketone	+	+
nitrile	-	-
nitro	-	-

+ = reduction - = no reduction ~ = other reaction

Ref: Lane, C.F. *Aldrichim. Acta* 1973, 6, 51.

DMAB and sodium borohydride are hazardous materials. For Safety Data Sheet, please contact Boron Specialties.

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